The international competitiveness of Chinese construction firms

Li, Puying

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The International Competitiveness of Chinese Construction Firms

By

Puying Li

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Declaration

I declare that this research is the result of my own work and expect where stated and referenced otherwise, all the written work and investigations are my own. This work has not been accepted or submitted for an academic award elsewhere.

Puying Li

Dedication

To my beloved parents Jianzheng and Xuelian, who gave me their unconditional love and support during the whole period of my education and have always given me the courage to overcome life's difficulties.

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Having finally completed this thesis, I would like to offer my appreciation to all the people who have made a contribution to the work.

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I would like to take this opportunity to thank all the participants in my research study; for their generosity in giving of their time to kindly meet with me for interviews, it is thanks to their cooperation that I have been able to finish the interview section successfully.

Last but not least, I offer my thanks to my lecturers, friends and library team at the RAU, Dr. Carol Zhang, Yaqub Murray, Jing Wang, Xia Hua, Yue Du, and Xuteng Zhang, who encouraged me during the hard work and gave me the best of friendships care and attention, this helped me to complete this research successfully. To the library team, for providing me with the many inter-library loans, which help me to conduct this research.

Abstract

Many Chinese construction firms have strategically started to develop their overseas construction markets in line with the development of the integration of global economies, following China's accession to the World Trade Organisation in 2001, and the Chinese government's 2013 proposal for the "One Belt One Road", which was an opportunity for Chinese construction firms to expand their global business. However, in the current dynamic global construction market there are factors, which may affect Chinese construction firms' global expansion. However, the competitiveness theories, such as, Porter's Competition theory, the Resources-Based Approach, and the Strategic Management Approach, had application limitations with respect to Chinese construction firms, because of the unique characteristics of China's construction industry, which is a socialist market economy and is moving towards integration into the global market. It has been important for Chinese construction firms to focus on investigating those indicators, which have contributed to their international operations. Therefore, it was necessary to establish a framework to assess and improve Chinese construction firms' international competitiveness.

A competitiveness framework was established through the application of mixed methods relating to a sequential explanatory strategy, with strong quantitative and qualitative considerations. For this sequential study, firstly, the key players in the competitive global construction market were identified through analysis of secondary quantitative data. Secondly, a total of 21 key competitiveness indicators were identified through analysis of secondary qualitative data, after which a draft conceptual competitiveness framework was proposed. Thirdly, Modified Delphi interviews were conducted, in order to refine and tighten the draft conceptual competitiveness framework, in all a total of 49 key competitiveness indicators were identified and a competitiveness framework was established. Finally, a case study was conducted through an analysis of both secondary data and structured interview results, which validated that the competitiveness framework was a strategy and a practical tool for assessing and improving Chinese construction firms' international competitiveness. In addition, a mathematical method named Weighted Summation was employed in this research for calculating competitiveness. Chinese construction firms' international competitiveness could then be calculated.

This research found that the meaning of competitiveness could not be precisely defined, but the indicators, which contributed to Chinese construction firms' international competitiveness could be identified. This research provided a useful learning tool to assess and improve construction firms' international competitiveness.

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Chapter One

Introduction

1.1 Proposal

Competitiveness is a disputed topic, which economists, politicians and researchers frequently discuss, and it is widely recognized as the core of the success or failure of firms. However, although there is widespread acceptance of its importance, competitiveness remains a concept that is neither well understood nor easy to communicate (Lu 2006). For example, Porter (1985) proposed that if a company attempted to provide customers with greater value and satisfaction than their competitors, a company must consider cost differences, markets differences, regulation differences, and resource differences. But Prahalad and Hamel (1990) considered that firms should develop unique resources in order to achieve a core competence to sustain growth, and establish a relationship between resources, capability, and core competencies. Nevertheless, D'Cruz and Rugman (1992) suggested that competitiveness could be defined as the ability of a firm to design, produce or market products superior to those offered by competitors with respect to price and non-price qualities. It can be seen that many scholars have different views on firms' competitiveness, they have provided rich concepts of competitiveness as theoretical tools. However, they did not have clear outcomes of competitiveness as a strategic tool for a firm's actual operation. As a result, they did not directly indicate which drivers facilitated a company to improve its competitiveness in the changing international market, and in the current dynamic global market, nonetheless, several indicators exist which may affect those firms aiming to expand their global businesses. Therefore, it is important to develop a new framework relating to competitiveness indicators in actual operation to facilitate an analysis of competitiveness.

Construction is a major industry throughout the world accounting for a sizeable proportion of most countries' economic output. For instance, the construction industry in the UK contributed £103 billion Pounds, amounting to 6.5 per cent of the total economic output in 2014 (Rhodes 2015). China's construction industry produced RMB ¥447.896 billion Yuan, accounting for 7.03 per cent of the total gross domestic product in 2014 (CSYB 2015). The construction sector combines a wide variety of human activities, as well as the infrastructure that connects these facilities into an increasingly complex network (Crosthwaite 2000). Globalization provides new possibilities, and new opportunities for some construction companies to invest in international projects, which has become a major preoccupation for global construction companies. However, some indicators could be adjusted in a dynamic global construction market, which could affect global firms' expansion overseas. For example, tendering, project types, regulations and emerging markets could be adapted differently (Han *et al.* 2010; Zilke and Taylor 2014). Therefore, global

construction firms are required to improve their competitiveness in order to respond to a changing global market, and from there to survive and grow in the global market.

In line with the development of the integration of global economies, and China's acceptance into the World Trade Organisation (WTO), the Chinese government has been encouraging, and supporting Chinese construction firms to compete for contracts in global markets (Wen 2005; Hu 2007; Zhao and Shen 2008). Encouragement has been given in order to strengthen bilateral and multilateral trade with other countries, to promote peaceful cooperation, and common development around the world (Office of the One Belt One Road (OBOR) 2017), the "One Belt One Road" policy, also called the "New Silk Road Economic Belt" was initiated by Chinese president Xi Jingping in 2013, and was published in 2015 (National Development and Reform Commission (NDRC) *et al.* 2015). This policy provided more opportunities for Chinese Construction Firms (CCFs) to enter the countries, which are located in the OBOR areas (Figure 1.1). In the first quarter of 2016, Chinese companies invested $3.59 billion dollars in the "Silk Road Economic Belt", including countries, such as, Singapore, India, and Malaysia. Moreover, Chinese construction firms signed 758 contracts with 60 'Silk Road Economic Belt' countries, thereby, achieving $25.59 billion dollars new contractual value, and $13.75 billion dollars turnover value (Ministry of Commerce of China (MOFCOM) 2016). These figures illustrated the potential for Chinese construction firms to expand their overseas business within the remits of the Silk Road Economic Belt.

Figure 1. 1: The map of One Belt One Road

Source: Ren (2017)

The Asian Infrastructure Investment Bank (AIIB) was another initiative, which was introduced in 2013 (Qi 2015). It is a new multilateral financial institution established to bring countries together to address the daunting infrastructure needs across Asia. According to the Articles of Agreement of the AIIB, the Bank will "provide or facilitate financing to any member, or any agency, instrumentality, or political subdivision thereof, or any entity or enterprise operating in the territory of a member, as well as to international or regional agencies or entities concerned with economic development of the Asia region" (AIIB 2017a). By May 2017, the bank had approved a total of 77 countries to become members of the AIIB (AIIB 2017b). This bank enabled CCFs undertake international projects with sufficient funds. These global initiatives by China illustrated the issues concerning competitiveness, and infrastructure finance to the attention of the global market.

In line with competitiveness theories, global construction market changes, and Chinese construction firms' global expansion perceptions were altered. Consequently, it has been considered necessary to fill any gap in competitiveness knowledge, understanding with respect to how Chinese construction firms' competitiveness might be applied to the global market. Hence, the purpose of this research is to investigate the international competitiveness of CCFs:

i. Examine the competitiveness of CCFs in the global market

ii. Outline a practicable competitiveness framework for CCFs to compete in the global construction market.

There are initial aspects of operational competitiveness, which are used in research: corporate strategies, organisational capability, and financial capability, as all, potentially, could affect international contractors' competitiveness when exploring overseas markets. This research has examined the indicators related to these three issues.

1.2 Scope of Research

It is necessary to limit the scope of research because competitiveness is comprised of different levels of analysis. A clear statement relating to the scope of the study facilitates not only the focus on research efforts, but also to increase the understanding of the competitiveness concept. Competitiveness is analysed on four different levels: the national level, the industry level, the firm level, and the project level.

Typical studies of competitiveness at the national level include Porter's Diamond Framework for achieving a nation's competitive advantage (Porter 1990); and the World Competitiveness Yearbook (IMD 2004) published annually to report on the competitiveness of nations. Construction competitiveness at the industrial level, such as "measuring construction

competitiveness in selected countries" was published by Flanagan *et al*. (2004), aiming to benchmark the competitiveness of the UK, Sweden's and Finland's construction industry against selected countries, and to identify strengths and weakness in domestic construction sectors that influence sustainable competitiveness. In comparison with the analysis of competitiveness at national or industrial levels, researching competitiveness at the firm's level limits its scope to within the boundary of a company, for example: Porter's competitiveness theory (Porter 1980; 1985), the Resource-based and Core Competence school (Draft 1983; Prahalad and Hamel 1990), and the Strategical Management school (Wheelen and Hunger 2002; Buckley *et al*. 1988). A particular research area in construction is to examine competitiveness at the project level, mainly to focus the research on construction companies that win contracts by competitive bidding, and with reference to quality performance issues in the project (Belohlav 1993; Shen *et al.* 2004).

After discussing the different levels of analysis of competitiveness, the scope of this research can be described. This research has been confined by the following set of boundaries:

(1) Level of analysis—at a firm's level. This study has focused on the competitiveness of a firm but found out the competitiveness relationship between the firm and national policy, and projects. A project is a major source of competitiveness for construction firms' production (Gao *et al.* 2013). Policy is the macro condition of an organisation's development, especially, since China carried out a series of policies concerning infrastructure development in order to increase its national economic and national bilateral relationships (Kuo *et al*. 2012);

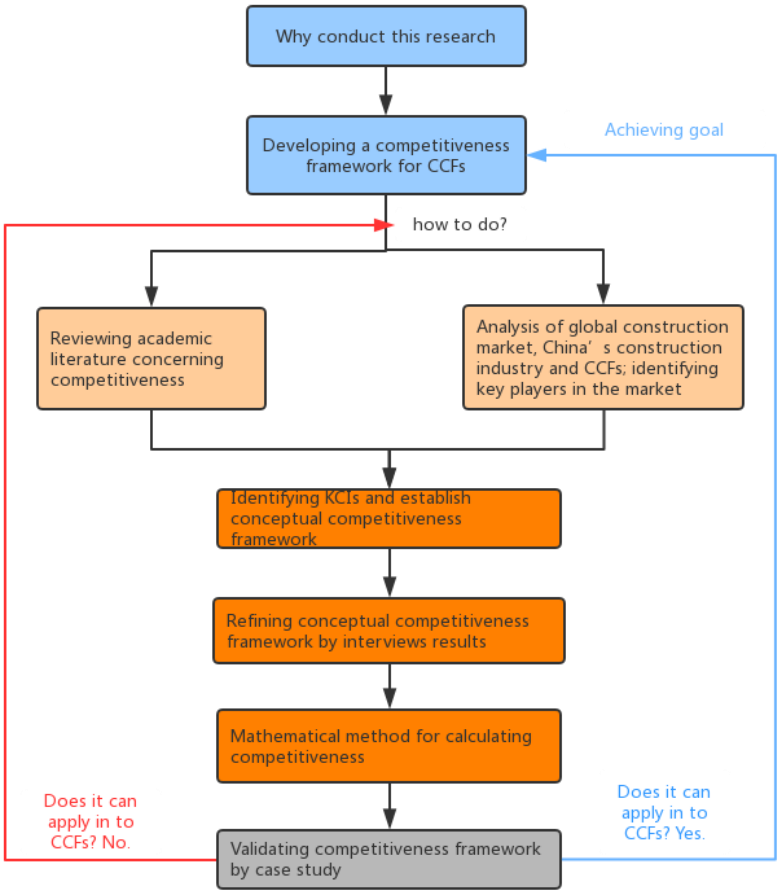
(2) Domain of firms—focusing on China's large construction firms, which have the capacity to undertake global projects;

(3) Market sector considerations—the general global construction market outside China.

1.3 Research logic

The logic of the study is shown in Figure 1.2. Three questions must be asked: First, a question: why conduct such a study about CCFs' competitiveness? Secondly, how to research in to CCFs' international competitiveness? Thirdly, can competitiveness be calculated, and given this competitiveness could a framework be applied to CCFs?

Figure 1. 2: Logic of the research



Source: Author (2014)

The reason for the first question is that by establishing a framework for improving CCFs' competitiveness is essential for them to survive, and then compete in the global construction market. This research has focused on CCFs to better understand their competitiveness. For the second question, this study has adopted a three-step strategy: the first step was a significant review of the relevant literature concerning competitiveness theories and models, the global construction market and China's construction industry, the CCFs' development, and key players in the global construction market. The second step involved identifying the Key Competitiveness Indicators (KCIs) based on the literature review in order to establish a draft conceptual competitiveness framework. The third step considered conducting interviews in order to refine the draft conceptual competitiveness framework. For the third question, this research considered a mathematical method for calculating competitiveness based on the framework, and to conduct a case study for validating the framework. Ultimately, it was felt that the goal of establishing a competitiveness framework for CCFs could be achieved.

1.4 Aim and objectives

In line with the research logic, the research aim, objectives, and questions could be addressed. The aim of this research was to investigate key indicators influencing the competitiveness of Chinese construction firms (CCFs) in the global market, in order to establish a competitiveness framework to facilitate CCFs' improving their international competitiveness.

The following objectives were identified:

Objective 1: Systematically to review theories and concepts of competitiveness.

Objective 2: To posit a draft conceptual competitiveness framework based on identifying the key competitiveness indicators (KCIs) from secondary data.

Objective 3: To refine the draft conceptual competitiveness framework.

Objective 4: To apply a mathematical method to calculate a construction firm's competitiveness.

Objective 5: To validate and reflect on the implication of the competitiveness framework.

The following questions have been investigated:

Question 1: What is the concept of competitiveness and how is it employed in the construction industry?

Question 2: What are the KCIs in the global construction market?

Question 3: Can an operational framework for construction firms' competitiveness be constructed?

Question 4: Can a firm's competitiveness be calculated?

Question 5: How competitive are Chinese construction firms?

Concerning the objectives and questions cited above, an appropriate methodology was needed to seek answers to those questions. Both qualitative and quantitative methods have been used to assist the investigation, and an analysis of the aim and objectives of these questions has been conducted.

1.5 Research methodology and data collection

The purpose of the methodology was to show the appropriateness of the techniques used to gather data and the methodological approach employed in the research. Previous studies from the literature are often employed to explore an understanding of data collection approaches, and methodological implications in order to justify their use over alternative techniques (Hart 1998).

This research followed four phases, namely: conceptual, exploratory, operational, and reflexive phases (Figure 1.3). Both deductive and inductive approaches should be employed in such a

comprehensive topic as this. A deductive approach is revealed in the literature review in the conceptual phase to understand the theory of competitiveness and to identify the KCIs for assessing construction firms within the changing global market; thus, a conceptual competitiveness framework could be established. An inductive approach in the last three phases has helped the researcher when investigating those KCIs, which have contributed to CCFs' international competitiveness in the global market.

A sequential explanatory strategy has been applied to the collection and analysis of both quantitative and qualitative data. For this sequential study, the researcher organised the research of procedures as the first step of this sequential study involving the collection and analysis of quantitative data via secondary resources in order to identify key global construction firms in the competitive global construction market, and to demonstrate how such firms responded to changing global market conditions.

The quantitative results informed the types of participants to be purposefully selected for the qualitative phase and types of questions, which would be asked of participants. Following that, the collection and analysis of primary quantitative and qualitative data by interview by employing the Modified Delphi method, and structured interviews in the case study have been undertaken. The interviews have been transliterated back-to-back to ensure functional equivalence of its items in the two languages.

The Modified Delphi method was applied in the interviews since Delphi's objective was to obtain the most reliable consensus of opinion from a group of experts. This facilitated the researcher's investigation into:

i. The international competitiveness issues of CCFs

ii. The KCIs drive CCFs' international competition in the global market

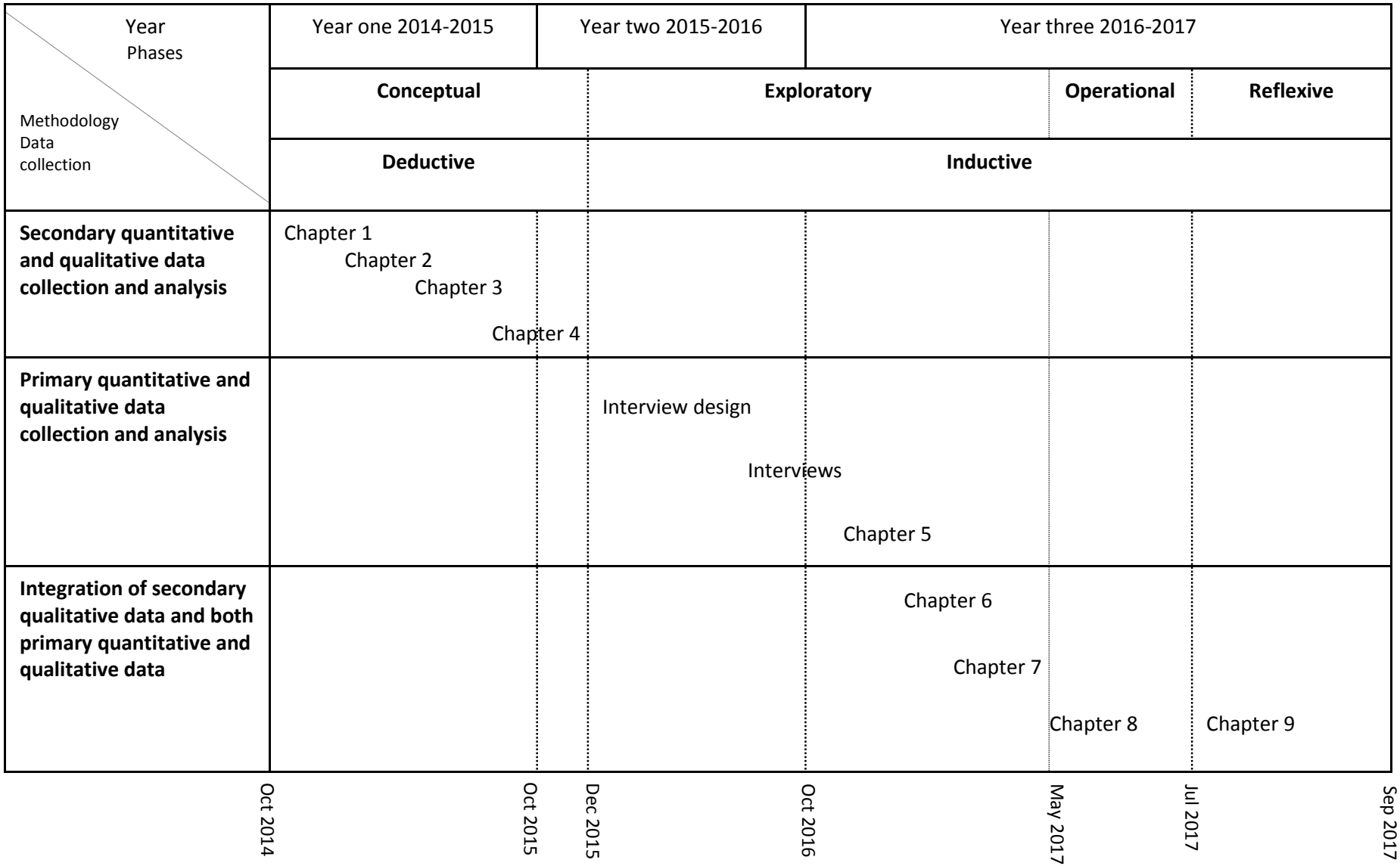
As such, the Modified Delphi method necessitated interviews with experts in the construction industry. According to the annual ranking of the "*Top 250 International Contractors*" by Engineering News Records, a total of 27 Chinese construction firms (CCFs) were ranked in the top 100 from 2004 to 2014. In order to investigate the KCIs, which contributed to CCFs' successful global operation, 14 experts were selected from those 27 CCFs in the Top 100 international contractors for interview. Additionally, 18 interviewees were selected outside the CCFs' Top 100 firms. These included 28 experts from construction companies, two scholars from British universities and two scholars from Chinese universities. The experts' knowledge and experience within the field of this study should be considered valid. Those experts had at least five years' work experience in overseas marketing; they held a management position and possessed a

relevant bachelor's degree. Moreover, an academic scholar who researched a related topic was selected for interview too. In this context, thirty Chinese experts and two UK scholars have been selected. The interview questions have been designed to relate to the research objectives, questions, and the draft conceptual competitiveness framework. Thus, in this research, three open-ended questions, and the KCIs' to be rated on a 5-point Likert scale have been designed.

The structured interviews were applied in the case study, which analysed of China General Nuclear Power Corporation (CGN)'s investment in Hinkley Point C power station (HPC) in the UK. The competitiveness framework was required to validate challenging sectors in the construction market; in addition, nuclear power construction was one of CCFs' international businesses. Thus, analysis of CGN's international competitiveness based on its investment in HPC could provide an interesting case study to validate competitiveness framework's practicability. However, this case study required experts understanding the case's issues, thus, two experts from the nuclear power construction industry were selected. This helped the researcher's investigation into:

i. The current issues of the UK and China's nuclear power construction development
ii. How CCFs engage in nuclear power construction in the UK
iii. What is CCFs' competitiveness in the British nuclear power construction industry
iv. Can the competitiveness framework be applied to CCFs

Figure 1. 3: The stage of research methodology



1.6 Structure

This research consisted of nine chapters divided into four phases (Figure 1.4 and Table 1.1). Phase one—conceptual, included chapters one to four, mainly focusing on the theoretical philosophies from the literature review. Phase two—exploratory, included chapters five to seven, focusing on the analysis of the Modified Delphi method interview results and a mathematical method for calculating competitiveness based on the results of the Modified Delphi interviews. Phase three—operational, included chapter eight, which considered the literature review and structured interviews in the case study within the competitiveness framework. The final phase—reflexive, concluded with recommendations from the principal findings.

Chapter one highlighted the background of the research, the research aim, objectives, scope, methodologies, and the structure of the thesis.

Chapter two illustrated the methodology employed in this research, this included mixed methods, a methodology strategy, interview approach, and data collection process.

Chapter three studied the literature surrounding theories of competitiveness, including academic journals, books, and policy reports with the object of understanding the concepts of competitiveness at a firm's level.

Chapter four systematically reviewed global construction markets, the Chinese construction industry and Chinese construction firms, the identification of key players and key changes in global construction markets, and an investigation of the KCIs through NVivo software based on academic theories and annual reports concerning the most important global construction firms. Furthermore, a draft conceptual competitiveness framework was established relating to KCIs.

Chapter five applied SPSS software to analyse the KCIs based on the quantitative interview results using the Modified Delphi Method. Therefore, the KCIs, which drove the CCFs' successful operations in the global market, could be identified. Thus, the draft conceptual competitiveness framework could be refined through the quantitative interview results.

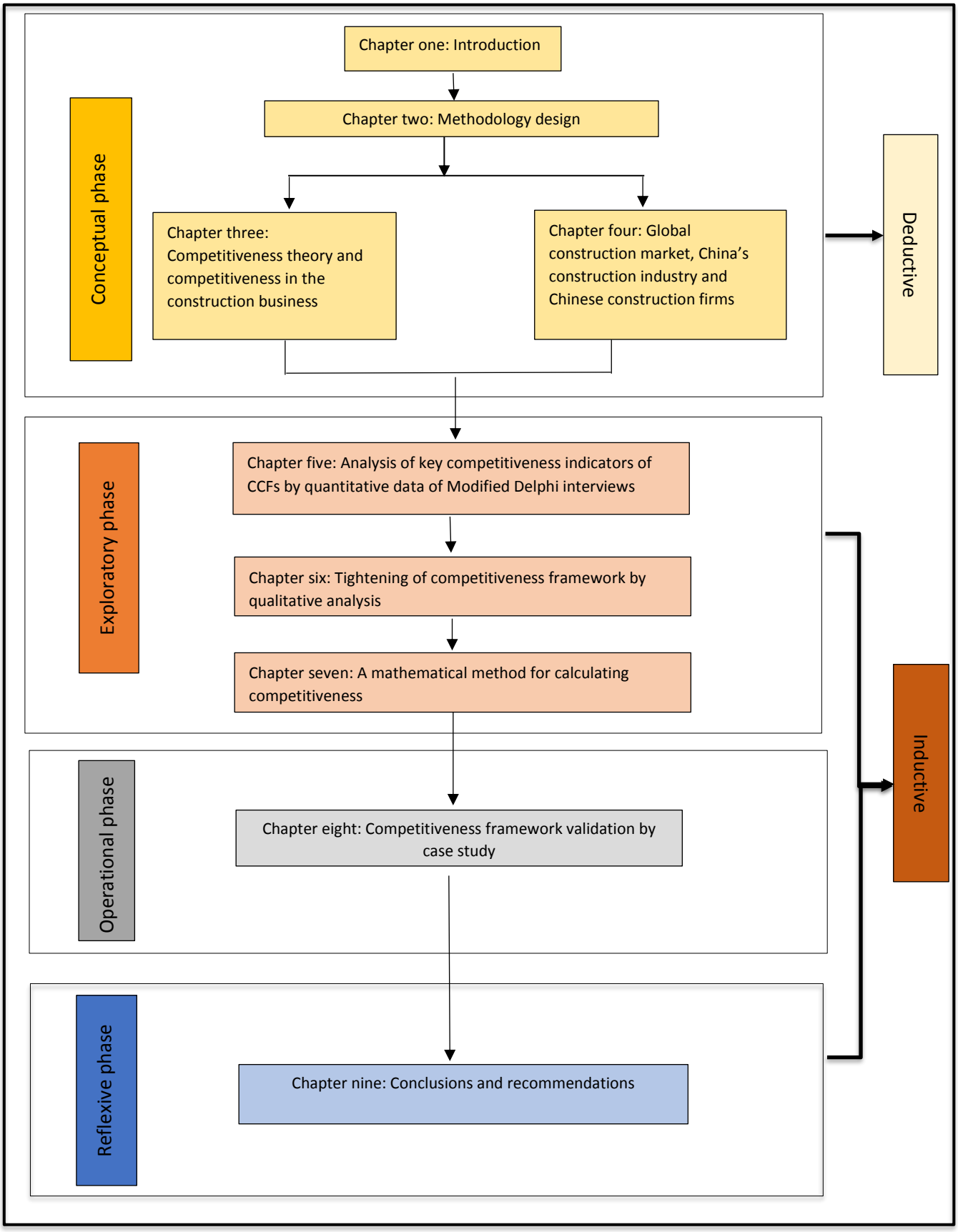
Chapter six clarified the refined competitiveness framework based on analysis from the qualitative interview results and the literature review to discover any gaps relating to KCIs between respondents and the literature review.

Chapter seven explored a mathematical method for calculating competitiveness based on the competitiveness framework. The weight of each KCI was calculated by the respondents' rating score and the calculation process of Weight Summation of the competitiveness framework has been illustrated.

Chapter eight tested the competitiveness framework through a case study: the operation of the China General Nuclear Power Cooperation in the Hinkley Point C power station, in order to demonstrate the practicability of the framework.

Chapter nine clarified the main findings, contributions, and limitations of this research, and made recommendations for potential areas for further research.

Figure 1. 4: Overview of the thesis structure



Source: Author (2014)

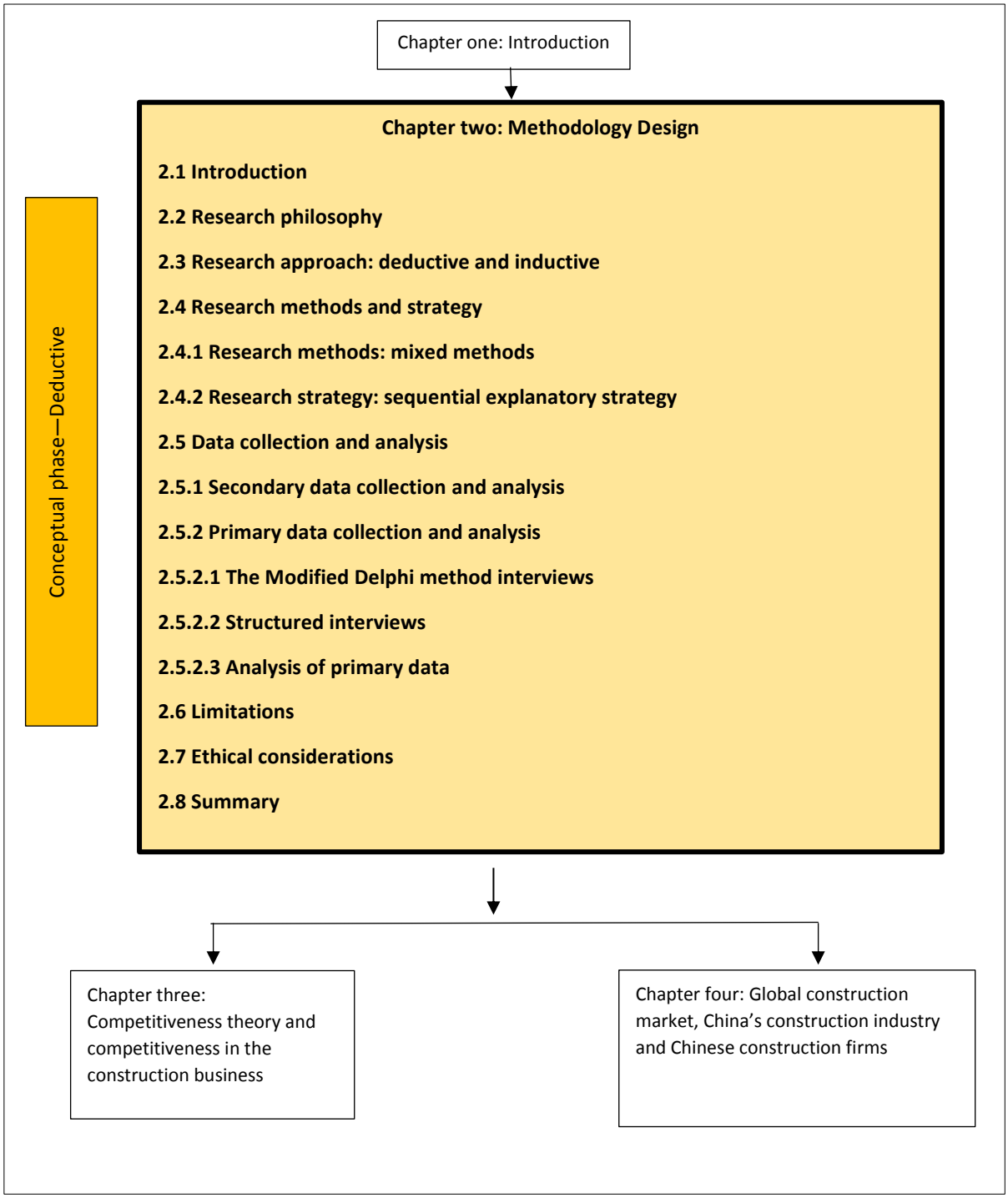
Table 1. 1: Summary of the thesis structure

Objectives	**Research Questions**	**Chapter**	**Method**
CONCEPTUAL PHASE			
Objective 1: Systematically to review theories and concepts of competitiveness.	Question 1: What is the concept of competitiveness and how is it employed in the construction industry?	Chapter 3	Literature review
Objective 2: To posit a conceptual competitiveness framework based on identifying the KCIs from secondary data.	Question 2: What are the KCIs in the global construction market?	Chapter 4	Literature review
EXPLORATORY PHASE			
Objective 3: To refine the conceptual competitiveness framework.	Question 3: Can an operational framework for construction firm's competitiveness be constructed?	Chapter 5 Chapter 6	Modified Delphi interviews
Objective 4: To apply a mathematical method calculating a construction firm's competitiveness.	Question 4: Can a firm's competitiveness be calculated?	Chapter 7	Mathematical method to calculate competitiveness
OPERATIONAL AND REFLEXIVE PHASE			
Objective 5: To validate and reflect on the implication of the competitiveness framework.	Question 5: How competitive are Chinese construction firms?	Chapter 8 Chapter 9	Case study with structured interviews; Review of principal findings and draw the conclusion

Source: Author (2014)

Chapter Two

Methodology design



2.1 Introduction

Chapter one outlined the motivation and background of the research, the aim and objectives, the logical of the research, the scope, methodologies and the structure of this thesis. The literature review conducted in the proposal stage showed that competitiveness was a complicated issue, the definition of competition and competitiveness indicators could not research agreement among researchers. Researchers still struggled to identify and explain the exact meaning of competitiveness. Moreover, analysis of the development of the global and Chinese construction industry, including CCFs in the literature review involved a large amount of both quantitative and qualitative data. For example, quantitative data included contractual value, GDP, international revenue, and the number of countries identified; qualitative data included the background of the global construction market, Chinese economic development concerning the construction industry, and CCFs transformation. Therefore, this research has approached the methodology design before the literature review, in order to seek an effective pathway to research this complicated topic. This chapter has focused on the methodology designed to clarify the method in order to conduct this study, as outlined in chapter one (Figure 1.2).

The aim of this research was to investigate key indicators influencing the competitiveness of Chinese Construction Firms (CCFs) in the global market, in order to establish a competitiveness framework in order that CCFs might assess and improve their international competitiveness.

In order to achieve this aim, both deductive and inductive research approaches were employed in this research. Mixed methods with sequential explanatory strategy were utilised to understand this study. For a sequential strategy study, both quantitative and qualitative data were required for collection and analysis. The first step of the methodology was an understanding of the notion of research approaches.

2.2 Research philosophy

Research philosophy can be defined as the development of the research background, research knowledge and its nature (Saunders and Thornhill 2007). Saunders, *et al.* (2009) added that in research philosophy each researcher followed important views on how they perceived the world, this view and its assumptions would greatly affect the research strategy and methodology which the researcher has chosen as part of the approach. Cohen *et al.* (2000) clarified that a research philosophy could help to identify the research paradigm, which comprised: perception, beliefs and understanding of several theories and practices that are used to conduct a research. It can also be characterized as a precise process, in which various steps are involved through which a researcher creates a relationship between the research objectives and questions. Understanding research philosophy is the first step to embarking on research (Creswell and Clark 2011).

Four major research philosophies have been identified in the Western tradition of science, namely: positivism, interpretivism, realism, and pragmatism (Bandaranayake 2012). Positivist follows in the tradition of the natural scientist. To generate a research strategy to collect these data, existing theories are normally employed to develop hypotheses. These hypotheses will be tested and confirmed, in whole or in part, or refuted, leading to the further development of theory which then may be tested by further research (Saunders *et al.* 2009). Interpretivism advocates the necessity for the researcher to understand differences between humans as social actors (Saunders *et al.* 2009). Realism is opposed to idealism, the theory proposes that only the mind and its contents exist (Saunders *et al.* 2009). Pragmatism argues that it is possible to work in both positivist and interpretivist ways (Bandaranayake 2012); pragmatism argues that the most important determinant of the research paradigms a researcher adopts is the research question. Tashakkori and Teddlie (1998) contend that pragmatism is intuitively appealing, largely because it avoids the researcher engaging in what they see as rather pointless debates about such concepts as truth and reality. In their view, the researcher should: "study what interests you and is of value to you, study in the different ways in which you deem appropriate and use the results in ways that can bring about positive consequences within your value system" (Tashakkori and Teddlie 1998: 30).

Four different components of research paradigms have commonly been discussed: epistemology, ontology, axiology, and methodology (Saunders *et al.* 2009; Creswell and Clark 2011)

Epistemology-- what is the relationship between the researcher and that being researched?

It concerns that the researcher's view regarding what constitutes acceptable knowledge. In this research, Epistemology could facilitate how the researcher understands the theory of competitiveness within the background of the global and Chinese construction industry, and the development of CCFs from a secondary literature review. However, the knowledge in the field of competitiveness, especially, the competitiveness of CCFs requires to further discussion and exploration, because it is still a vague concept. Thus, Epistemology could not constitute appropriate paradigm in this research.

Ontology-- what is the nature of reality?

It is commonly believed that assumptions that are created to understand the real nature of the society. How things really are and how things really work. One of aspect of ontology involves a discussion of objectivism, this describes the position that social entities exist in reality external to social actors concerned with their existence. In this research, Otology facilitates an understanding of the nature of competitiveness. Competition is an objective and ubiquitous existence in the

market in the real world, but ontology could not point out a clear pathway to research as to how a firm could respond to the competitive market. Therefore, ontology is not an appropriate paradigm for this research.

Axiology-- what is the role of values?

It is a branch of philosophy that studies judgements about values; it concerns the researcher's view of the role of values in research. Heron (1996) argued that the role of values was the guiding reason for all human action. Saunders *et al.* (2009) stated that the role that researcher's own values played in all stages of the research process and was of great importance if the researcher wished the research results to be credible; Choice of philosophical approach was a reflection of the researcher's values, as is researcher's choice of data collection techniques. Axiology would help the author to consider which philosophical approach and research method would be appropriate for this research, in order to achieve credible research results, such as, what kinds of academic papers needed to be examined? What kinds of secondary data needed to be analysed? What kinds of primary data collection methods needed to be conducted, for example, a survey or interviews?

Methodology—what is the process of research?

It combination of different techniques that are used by the researcher to investigate different situations. It considers that what tools are to be used to understand that reality and changes in the reality (Creswell and Clark 2011). Thus, a methodological paradigm was applied in this research. Because it allows the author to seek a clear pathway to collect and analyse data, in order to achieve the research aim.

As mentioned above, four research philosophies are dominant: positivism, interpretivism, realism, and pragmatism. But all four research philosophies take different stances on the research paradigms, see Table 2.1. Consequently, it is necessary for the researcher to understand the philosophical position of research issues to understand the different combinations of research methods.

Table 2. 1: Summary of the four types of research philosophies in research paradigms

Source: Saunders *et al.* (2009)

The Table 2.1 illustrated that pragmatism with respect to methodology was the best research philosophy for this research. Because it allowed for mixed methods to be applied in the research, in order to effectively research the competitiveness concepts and competitiveness issues in the

both the global market and Chinese construction firms. The research approach and the research method have been illustrated in next sections based on the pragmatism of the methodology.

2.3 Research Approaches: deductive and inductive

In research, there are two broad methods of reasoning they are referred to as deductive and inductive approaches (Burney 2008).

Deductive

Deductive reasoning works from the more general to the more specific, it is informally called a "top-down" approach. A conclusion follows logically from premises. A deductive approach is an extremely influential and intellectual approach, in which a conceptual and theoretical framework is developed and tested using empirical observation (Hussey and Hussey 1997; Sekaran and Bougie 2010).

Figure 2. 1: Deductive process

Source: Author (2015) adapted from Hussey and Hussey (1997)

Inductive

Inductive reasoning works from specific observations to broader generalizations and theories. It is called a "bottom up" approach. A conclusion is likely to be based on premises that involve a degree of uncertainty. An inductive research is an approach whereby, theory is developed from observing an empirical reality that, typically, contrasts with the deductive method (Hussey and Hussey 1997; Sekaran and Bougie 2010).

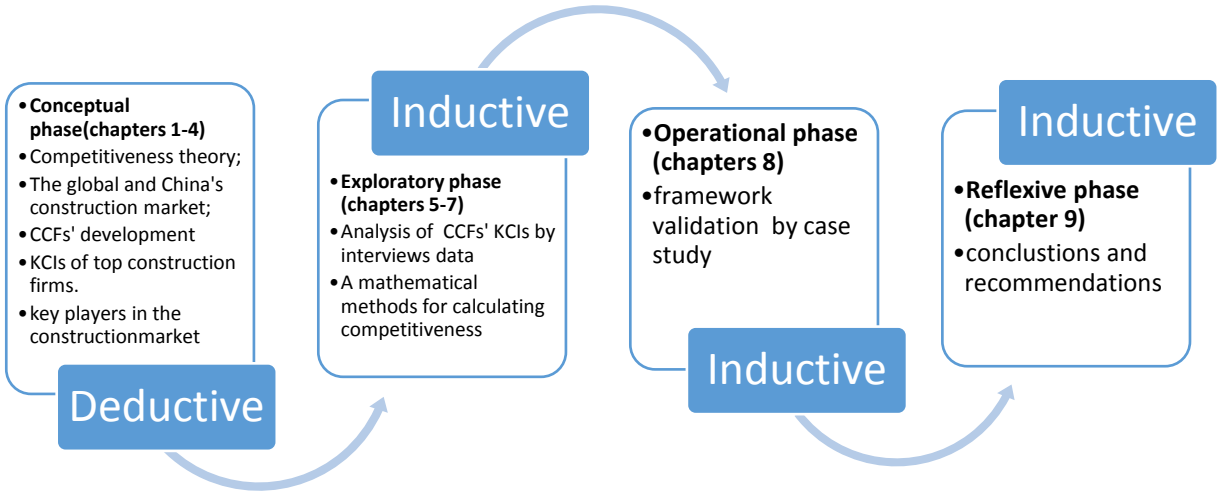
Figure 2. 2: Inductive process

Some materials have been removed due to 3rd party copyright. The unabridged version can be viewed in Lancester Library - Coventry University.

Source: Author (2015) adapted from Hussey and Hussey (1997).

However, according to Saunders *et al*. (2012), the deductive approach is commonly used by researchers associated with a traditional natural scientific inquiry (positivism), while an inductive approach is usually based on phenomenology (interpretivism). At times, these research paradigms or approaches are used together in research to explain better an occurrence or phenomenon. Thus, both deductive and inductive approaches have been adopted in this research (Figure 2.3).

Figure 2. 3: Deductive and inductive design of this research



Source: Author (2015)

A deductive approach facilitates the researcher's understanding of the notions of competitiveness theories and assists in identifying the key competitiveness indicators of global construction firms, in order to establish a draft conceptual competitiveness framework (Chapters 3-4). An inductive approach of research focuses on investigating the drivers, that contribute to the top CCFs' successfully responding to the changing global market, in order to refine and test the conceptual competitiveness framework (Chapters 5-8).

2.4 Research Methods and Strategy

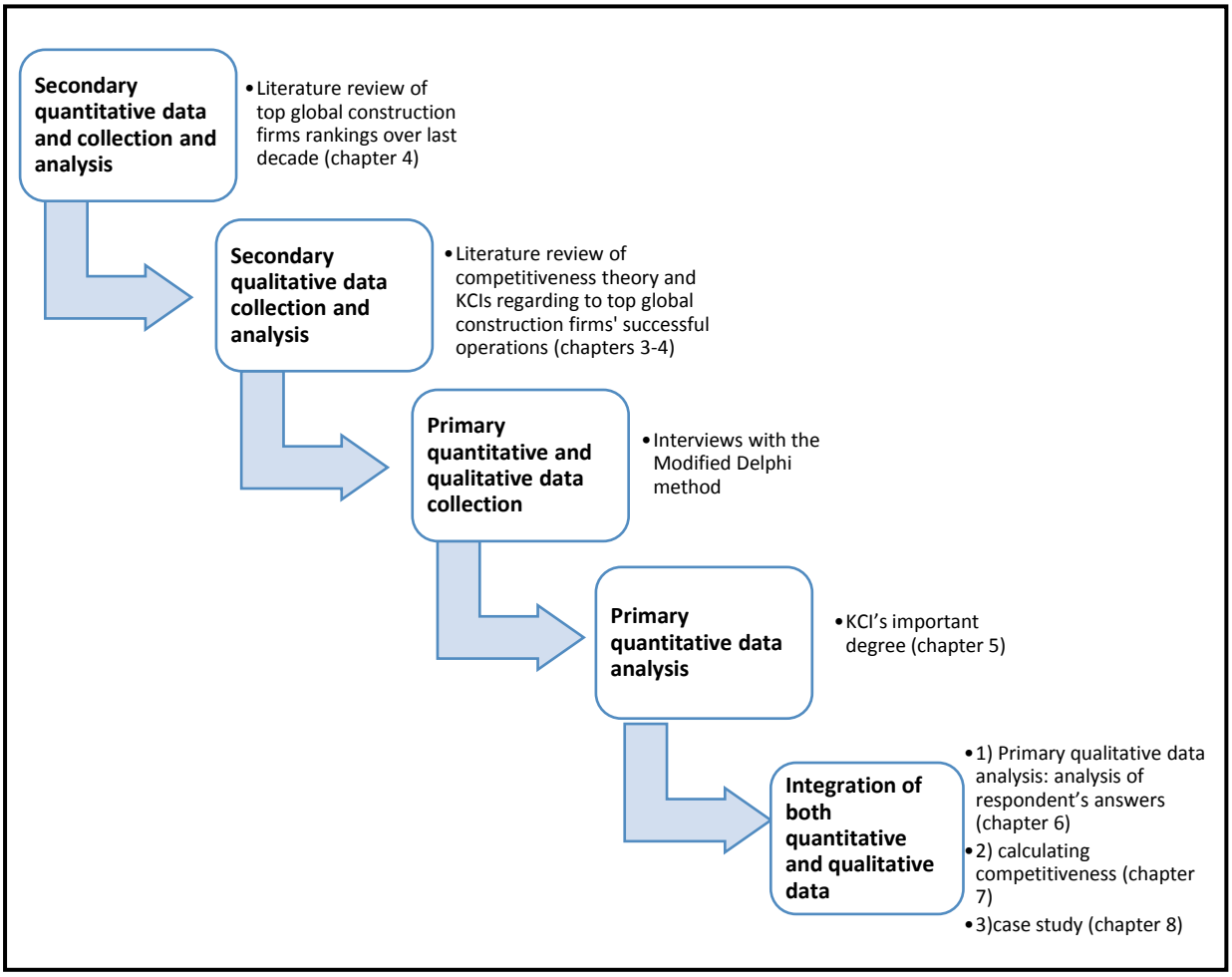
2.4.1 Research methods: Mixed methods

Mixed methods research is an approach to investigation involving collecting both quantitative and qualitative data and then integrating the two forms of data; according to Creswell (2009), quantitative or qualitative methods each has its own inherent weaknesses, but would be greatly strengthened when combined with the unique qualities of the other. Therefore, a mixed method approach has been chosen because of its strength of drawing upon both quantitative and qualitative research and minimising the limitations of both approaches. Because combining both quantitative and qualitative approaches a more complete understanding of this comprehensive topic has been established; and a more profound diverse analysis of both secondary and primary data have been provided in order to investigate the key competitiveness indicators, which characterise CCFs' international businesses. The details of quantitative and qualitative methods in this research have been explained in next section 2.4.2.

2.4.2 Research strategy: Sequential Explanatory Strategy

A sequential explanatory strategy is a popular strategy of mixed methods that has been adopted by researchers with strong quantitative and qualitative leanings. It is, normally, characterized by the collection and analysis of quantitative data in a first phase of research, followed by the collection and analysis of qualitative data in a second phase, on which the results of the research have, initially, been built. These methodological procedures are those that the researcher seeks to elaborate on or to expand on, following the findings of one method compared with another method (Creswell 2009). In order to achieve the research aim, a sequential explanatory strategy was adopted in this research (Figure 2.4).

Figure 2. 4: Sequential explanatory strategy design of this research



Source: Author (2015)

This sequential study of CCFs' international competitiveness examined, first, a collection and analysis of quantitative data by secondary resources in the conceptual phase, in order to investigate which construction firms were key players in the competitive global construction market. Secondly, collection and analysis of qualitative data from academic papers and key players' annual reports, in order to identify KCIs, Thus, a draft of conceptual competitiveness framework was established (chapter 3-4). After the secondary data analysis, the research collected and analysed primary quantitative and qualitative data through interviews using the Modified Delphi method in the exploratory phase (chapter 5), in order to investigate:

i. The international competitiveness issues of Chinese construction firms
ii. How top Chinese construction firms' operations were successful in the changing global market
iii. The important level of key competitiveness indicators

After an analysis of primary quantitative data, this research searched for an interpretation of both quantitative and qualitative data, in order to generate the key competitiveness indicators, to refine the competitiveness framework and identify a mathematic method for calculating competitiveness in the exploratory phase (chapter 6-7); to validate the competitiveness framework's practicability through a case study in the operational phase (chapter 8).

A case study was conducted to validate the framework's practicability after the competitiveness framework was established. Because a case study allows researchers to collect and present information in a way that provides more context, and instrumental for showing how something happens (Kane and Brun 2001). However, there is no formula in how to conduct a case study, it depends in large part on the research questions, which require an extensive and in-depth description of some social phenomenon (Yin 2014). In research, the question must precede the method, and the question should determine the method, which should be used to answer the question (Thomas 2011). According to research question 5: How competitive are Chinese construction firms? How should a case study be conducted to answer it?

Consequently, a selection of the research case should be related to the research theory or theoretical propositions of interest; a single case study can represent a significant contribution to knowledge and theory building by confirming, challenging, or extending the theory; such a study can even help to refocus future investigations in an entire field (Yin 2014). A case study, refers to one thing, it is about the particular, rather than the general (Thomas 2011). Stake (1995: xi) pointed out: "case study is the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances." Therefore, it was deemed necessary to select a particular activity, in which a Chinese firm was involved abroad. This would examine special and complex international operational issues relating to that Chinese firm's involvement.

However, Thomas (2011) suggested that three kinds of case studies needed to be considered before select a case, including: 1) a key case, which is a good example of something, a classic or exemplary case; 2) outlier case, which is an outlier revealing its importance because of its difference from the norm; and 3) the local knowledge case, which is an example of something from personal experience about which researchers want to find out more. In respect of the above precepts, this research needed to select a key case, which was a good example to illustrate CCFs' international competitiveness issues. Therefore, China General Nuclear Power Corporation (CGN)'s involvement in the operation of Hinkley Point C (HPC) power station in the UK was selected as a case study. As a nuclear power station has formed one challenging sector of CCFs' international businesses, advanced and special engineering technologies are required, involving experts, and high risks. Moreover, HPC might be viewed as China's significant attempt to obtain a foothold in the UK's nuclear power industry, in which the two nations' political issues might be

investigated. Therefore, CGN's investment and operation performance in HPC could be an interesting case for this research. As Thomas (2011) noted that when choosing a single case study, characteristics relating to it must offer significant interest. By applying the competitiveness framework to a CCF has helped the author to understand which competitiveness issues have been addressed. Furthermore, the case study revealed how the competitiveness framework operated in CCFs in the global market.

A case study offers researchers a rich picture with many insights coming from different angles, from different kinds of information. Thus, researchers might approach a case study and conduct interviews, make observations, keep a diary, and examine statistics (Thomas 2016). The details of case study's data collection and analysis have been explained in the next section 2.5.

Both quantitative and qualitative data relating to sequential explanatory strategy have been incorporated in to this research. According to Fellows and Liu (2015), trust and confidence were considered as important considerations in data collection and analysis. Therefore, this research designed a pathway to collect and analyse trust and confidential data.

2.5 Data collection and analysis

As section 2.3 mentioned, both quantitative and qualitative data were required in order to achieve the research aim. Bell (2010) noted that whatever procedure for collecting data was selected, it should always be examined critically to assess to what extent it was likely to be reliable and valid. With reference to this, this section designed an appropriate method to collect and analyse both quantitative and qualitative data from secondary and primary sources, in order to ensure research data's reliability and validity.

2.5.1 Secondary data collection and analysis

Secondary data are required for the background to the study. It is common in research to rely on secondary data for actual research investigations rather than generating new primary data from the field (Walliman 2011). The secondary data were collected in this research (Table 2.2) mainly based on a critical literature review, including academic papers, statistical data, and policy reports. These data were identified and analysed from chapters three the literature review to chapter eight the case study.

Table 2.2: Main secondary quantitative and qualitative data sources

Types	**Sources**	**Data**
Secondary quantitative data	China Statistical Yearbook (2004-2015)	The gross output values Value added of construction Number of countries Number of contracts Contractual value Annual turnover value
	Engineering News Record (ENR) (2004-2014)	Firms' international revenue Firms' annual revenue Contracts revenue Number of complete projects Annual ranking of top international contractors
	World Bank	Risk, GDP and inflation
Secondary qualitative data	Firms' official websites, news websites and newspapers	Marketing development strategies Organisational management
	Academic papers (for example: International Journal of Business Management & Economic Research; Journal of Construction Engineering and Management; Construction Management and Economics)	Competitiveness theory, models, and indicators

Source: Author (2015)

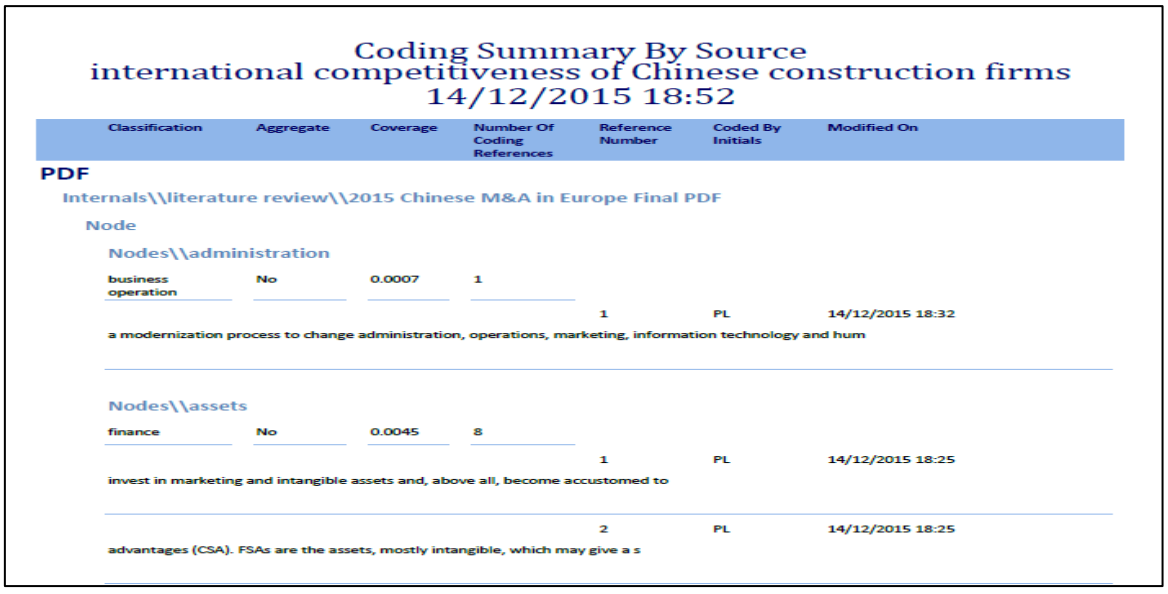
These secondary data added to an improved understanding of the current issues of competitiveness theory, providing an insight in to the global construction market's variety, China's construction industry and CCFs' development and key competitiveness indicators of global construction companies in the literature review (chapters 3-4); Assisted in understanding the KCIs' importance in the primary qualitative data analysis (chapters 6); it contributed to understanding the competitiveness issues of CGN's investment and operations in the HPC case study (chapter 8).

Quantitative analysis deals with data in the form of numbers and uses mathematical operations to investigate their properties (Walliman 2011). Analysis of secondary quantitative data is very

important in this research, because in the background of the global construction market, China's construction industry and CCFs' global operations have involved large volumes of statistical data, such as the contractual value, the number of contracts and firms' international revenue were required to be presented coherently. Crowther and Lancaster (2009) considered that quantitative data could be divided into two types: descriptive statistics and relational statistics. Some secondary quantitative data for this research were processed employing statistical data with a time series line, which is a graphical representation of data progression. It has helped to facilitate an analysis of the development of global construction market and China's construction industry.

Qualitative analysis involves the analysis of data that would not amenable to numerical measurement (Crowther and Lancaster 2009). Grounded theory is one of the methods and approaches, which was first proposed by Glaser and Strauss (1967) when analysing considerable qualitative data. This will vary according to the nature and purpose of each research project and the predilections relating to the individual research. In grounded theory, the researcher would take the qualitative data, and attempt to identify key themes, patterns and categories from the data itself (Crowther and Lancaster 2009). Thus, it has been determined that grounded theory would be an appropriate approach to analyse the KCIs from the secondary literature review. In grounded theory, the disaggregation of data into unites is referred to as open coding, the process of recognising relationships between categories is referred to as axial coding, and the integration of categories to produce a theory is labelled selective coding (Strauss and Corbin 2008; Saunders, *et al.* 2009). Bearing this in mind, the key words and phrases relevant to construction firms' competitiveness were analysed in secondary qualitative data with applied NVivo software (Figure 2.5).

Figure 2. 5: A small sample of KCIs' coding report by NVivo



Coding Summary By Source
international competitiveness of Chinese construction firms
14/12/2015 18:52

Classification	Aggregate	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
PDF						
Internals\\literature review\\2015 Chinese M&A in Europe Final PDF						
Node						
Nodes\\administration						
business operation	No	0.0007	1			
				1	PL	14/12/2015 18:32
a modernization process to change administration, operations, marketing, information technology and hum						
Nodes\\assets						
finance	No	0.0045	8			
				1	PL	14/12/2015 18:25
invest in marketing and intangible assets and, above all, become accustomed to						
				2	PL	14/12/2015 18:25
advantages (CSA). FSAs are the assets, mostly intangible, which may give a s						

Source: Author (2015)

Based on the NVivo coding, the KCIs contributed to construction firms' international businesses were identified, and a draft conceptual competitiveness framework was proposed.

2.5.2 Primary data collection and analysis

According to the sequential explanatory strategy, primary data are required to be collected and analysed following secondary data collection and analysis. A draft conceptual competitiveness framework was proposed based on the secondary data. Thus, a series of interviews, as one of the research methods, was chosen in this sequential mixed methods research, in order to provide some inductive assurance that the competitiveness framework was comprehensive and generalisable, in order to provide rich descriptive and contextual insights in to CCFs' international operations and their competitiveness in the global market, and to compare the results with secondary data in order to triangulate the findings and put secondary data into a larger context.

Smith *et al.* (2013) considered that an interview was often described as an "a conversation with a purpose"; the aim of an interview was largely to facilitate an interaction which permits participants to tell their own stories, in their own words. For this reason, the author has introduced individual interviews via face to face, and online chatting software (Skype, QQ and Wechat) with each participant in order to encourage participants to talk openly about their experiences and opinions. According to Fellows and Liu (2015), the aim of primary data collection was to maximise the amount and accuracy of transfer of meaning from the provider to the researcher, in a structured method, the pre-determination of what data were to be collected was critical, and the selection of providers of the data was also likely to be critical. Thus, the interview questions were designed from the competitiveness framework and the results from the secondary data analysis were used in order to gain valuable primary data for this research.

This research necessitated two interviews to be conducted, one involved Modified-Delphi interviews, which aimed to understand completely interviewees' opinions related to the CCFs' international competition, and to compare the differences between the KCIs they identified in answers and the KCIs that emerged from the literature review, and to establish a competitiveness framework (chapters 5-6). The other one used structured interviews in the case study, which aimed at understanding the current issues of CCFs' investment and operations in the UK's nuclear power construction market, and, moreover, to validate the competitiveness framework's practicability (chapter 8).

2.5.2.1 The Modified Delphi method interviews

The Delphi process is a research technique that combines both qualitative and quantitative approaches to explore the future (Boyd *et al*. 2014). It has been applied in many complex areas to further an investigation in to a variety of local, regional, and global issues, in which a consensus is

to be reached (Musa *et al*. 2015). It is also understood to act as a tool for reaching experts' consensus through scientific discussion, and helping to solve complex situations in which, while scientific knowledge elements are relatively certain, the relations between variables are very complex (Smith *et al.* 2013). A Delphi study is flexible in its design and responsive to follow-up interviews. This permits the collection of richer data to provide a deeper understanding of the basic research questions (Okoli and Pawlowski 2004). Moreover, Delphi's object is to obtain the most reliable consensus of opinion of a group of experts. It involves the repeated individual questioning of experts by interview or questionnaire, and avoids direct confrontation between experts with one another (Dalkey and Helmer 1962). Its features are anonymity, iteration with controlled feedback and statistical response (Dickey and Watts 1978). The iterative nature of the procedure generates new information for panellists in each round, enabling them to modify their assessments. It can represent the best forecast available from a consensus of experts (Corotis *et al*. 1981).

The conventional Delphi method is comprised of three individual phases. The first phase explores the subject being researched, giving participants the opportunity to contribute information they feel appropriate. The second phase moves to determine an understanding of how the entire group views the issue. If significant disagreement is evident, the third phase is used to explore that disagreement and gather information related to it (Linstone and Turoff, 1975). The Modified Delphi method is similar to the conventional Delphi in terms of process, such as a sequence of rounds with selected experts and to arrive at a consensus. But, the Modified Delphi method involves beginning the process with a set of carefully selected items. These pre-selected items might be drawn from various secondary literature resources, and then interviews are conducted with selected experts with knowledge of the subject (Custer *et al.* 1999). The major advantages of the Modified Delphi are that it, typically, improves the initial round response rate, providing a solid grounding related to previously developed work, reducing the effects of bias owing to group interaction, and providing controlled feedback to participants (Dalkey 1972; Judd 1972; Custer *et al.* 1999). The Modified Delphi method could be applied when the consensus of experts on complex, subjective and uncertain issues has been determined, where participants are separated by physical distance (Linstone and Turoff 1975; Jones and Hunter 2000; Chan *et al.* 2001).

With reference to the research's aim and objectives, this research's main task was to undertake an investigation into key competitiveness indicators, which would contribute to construction companies' success when responding to the changing global construction market, and, by doing so, to expand overseas business. This required knowledge from people who understood these complex issues. Therefore, the Modified Delphi method was selected as an appropriate approach in the research interviews. It promoted the collection of detailed data by a researcher from

experts who had a rich knowledge and experience of CCFs' operations in overseas markets. These experts' opinions would enhance the author's understanding of the current issues of CCFs in the competitive global market and would assist in refining a competitiveness framework.

As Hallowell and Gambatese (2010) suggested, the choice of a specific design and the methodology of a Modified Delphi process would depend on the research questions defined by the analyst, and significantly, from previous studies. The interview process by the Modified-Delphi method is shown in Figure 2.6.

Figure 2. 6: Interviews process by Modified Delphi method

Source: Author adapted from Pike *et al*. (2015)

Figure 2.6 has indicated first that invitation letters were sent to the nominated participants by email, first to ask them to complete a Modified Delphi interview. The participants answered the questions, and rated the importance of each competitiveness indicator on a 5-point scale (1=very low importance to 5=very high importance). The questionnaire provided the participants with opportunities to add additional comments. During the second round, the experts were presented with feedback results for each indicator rated in first round, after which they were allowed to change their previous answers via feedback; interview rounds were not to be stopped until Kendall's *W* coefficient of concordance had achieved a satisfactory agreement (Cafiso *et al.* 2013).

However, experts' panel selection was an important component in the Delphi method (Dalkey and Helmer 1962; Musa *et al.* 2015), as a group of experts was selected to provide their opinions and judgments, which would contribute to the research results (Donohoe 2011). Those experts involved in a Delphi study refers to professionals or researchers having special knowledge, experience, which are evidenced by several specific requirements such as professional qualifications, working experience, and relevance (Hallowell 2008). Four "expertise" requirements could be taken into account: knowledge and experience in the field of study; ability and willingness to participate; adequate time to participate and effective communication skills (Musa *et al.* 2015).

This study selects its sample from Chinese construction industry experts based on the following criteria, which were planned to correctly identify eligible participants for the Modified Delphi interviews:

i. Work experience in overseas marketing
ii. A management position and
iii. A relevant bachelor's degree

Only practitioners who met all the sampling criteria were selected in order to obtain the most valuable opinions. First, the author identified the CCFs, which have qualification to undertake international projects, and scholars who had researched relevant topics. The appropriate participants' names were taken from the website of companies and universities based on the interview requirements above; they were then contacted to ask them to participate in a Modified Delphi interview. Some respondents introduced their colleagues to participate in this research. Secondly, a total of 32 construction experts were agreed to act as respondents, including 14 experts who were from the top 100 Chinese construction firms, and 14 further experts were selected from other Chinese construction firms. In addition, two Chinese scholars and two British scholars were selected as interviewees in order to understand their academic opinions about global construction companies' successful operations in the global market. As Geist (2010) and Ameyaw *et al*. (2014) recommends, the Modified Delphi method has established an appropriate size range from 20-60 number of participants. For the list of experts see Appendix I, although pseudonyms have been used to disguise the names of the interviewees and companies to protect anonymity, thereby, adhering to research ethical considerations.

Because of the distance separating Chinese respondents, the author interviewed Chinese experts, who worked outside the UK on video call via QQ and WeChat social software; and interviewed the UK experts in their private working offices. This complied with the research ethical requirement by Coventry University (2013) that all research activities were to be carried out on premises which fulfilled all requirements of current UK Health and Safety legislation and good practice. However,

some potential bias was seen to exist in the interviews, such as stereotyping, because the participants had been working in international construction for long time, they have their own knowledge, experience and feelings about overseas construction jobs. To avoiding potential bias was a prerequisite to be considered before the interviews were designed. Firstly, appropriate interview questions were constructed based on the research aim and objectives; secondly, in interviews, questions were only asked and discussed that related to the interviewees' working background, in order to allow respondents to answer questions about which they had knowledge, combined with their professional knowledge and working experience. In order to gain a more profound insight into this research, the Modified Delphi interview questions were designed to reflect the research's objectives, questions and the draft conceptual framework (Table 2.3).

Table 2. 3: Modified Delphi Interview questions design

Research Objectives	**Research Questions**	**Modified-Delphi interview questions (first round)**
Objective 1. Systematically review theories and concepts of competitiveness.	Question 1. What is the concept of competitiveness and how generation in construction industry?	1. In your view, what are the current issues affecting the international and Chinese construction firms' entry into the overseas market? 2. In your view, how is it possible to evaluate whether a construction firm has been successful or unsuccessful in the market? 3. In your view, how do top international and Chinese construction firms operate successfully in the changing global market?
Objective 5. To validate and reflect on the implication of the competitiveness framework	Question 5. How competitive are Chinese construction firms?	
Objective 2. To posit a conceptual competitiveness framework based on identifying the key competitiveness indicators (KCIs) from secondary data	Question 2. What are the KCIs in the global construction market?	4. Key competitiveness indicators rated on a 5-point scale 5. Propose additional competitiveness indicators
Objective 3. To refine the conceptual competitiveness framework	Question 3. Can an operational framework for construction firm's competitiveness be constructed	
Objective 4. To apply a mathematical method to calculate a construction firm's competitiveness	Question 4. Can a firm's competitiveness be calculated?	

Source: Author (2015)

The key part of Modified Delphi interviews was the KCIs rated on a 5-point Likert scale, which was developed in a structured format in order to assess a list of pre-defined KCIs' importance degree, which was drawn from the literatures. A set of 21 KCIs was established for the experts' consensus initiatives.

The first round of Modified Delphi interviews comprised both open-ended and closed questions as shown in Table 2.2 (Appendix II). The adoption of an open-ended question format was consistent with the requirement of the Modified Delphi method and it was difficult for the researcher to assemble these indicators together from previous literature considering construction firms' management. Closed questions asked the participants to rate the importance of each indicator on a 5-point scale (1= not important, 5= highly important). Giannarou and Zervas (2014) researched 32 studies, which using Delphi technique in the scientific fields of management and business, found out that 10-point and 5-point scales rating were the most common methods. Ameyaw *et al*. (2014) identified 88 Delphi papers and nearly half of them adopted a Likert scale to quantify the opinions; the attitude scales adopted in the identified Delphi papers were in a range of between 3 and 12; the 5-point Likert scale was used mostly. This research adopted a 5-point Likert scale rating rather than ranking, because 21 KCIs were identified from the literature review, a 5-point scale rating is more convenient for participants to consider the each KCI's importance degree rather than only ranking all of 21 KCIs' importance position. This is to adhere to Coventry University's (2013) research ethic: "*the design of the study is appropriate for the questions being asked*."

Moreover, participants were asked to provide additional key competitiveness indicators which they considered could support Chinese firms improving their competitiveness in international markets.

In the second round of interviews, the experts were presented with feedback results for each indicator rated in the first round of interviews (Appendix II). The experts were given this information to help them revise their ratings: (1) the maximum and minimum rate score for each indicator; (2) the mean score for the each indicator; (3) the level of consensus, based on the value of Kendall's *W*; and (4) a paragraph summarising the other participants' comments on why they rated that item as they did. Based on this, the experts were asked to revise their ratings for each item, moreover, they were asked to explain their ratings and revisions.

2.5.2.2 Structured interviews

Kumar (2011) explained that in a structured interview, the researcher asks a predetermined set of questions, using the same wording and order of questions as specified in the interview schedule; an interview schedule is a written list of questions, prepared for use by an interviewer in a person-to-person interaction. A structured interview provides uniform information, which assures the comparability of data. After the competitiveness framework was established, the competitiveness framework was required to validate its practicability in CCFs' international operations, thus, a structured interview was selected as a method of data collection in the case study. Katz (1983) noted that four points are required to be established in interviews:

representativeness, influencing, reliability, and replication. Therefore, selection of appropriate interviewees is one of the important issues in the structured interview. In order to achieve the aim of the case study, the case study structured interviews have been based on the following criteria:

i. Working experience in a nuclear power station
ii. A management position or technical position and
iii. Rich knowledge of the UK and China's nuclear power construction market

In qualitative research, a sample size for interview, was not considered important, it depended upon who was likely to provide the researcher with the best information (Kumar 2011). In the case study for this research, two respondents were selected, the limited number of respondents was, because the nuclear power industry is a high technical, security minded, and sensitive industry, where not many experts are involved. In this instance, one was a nuclear power technical manager in a CCF, and the other one was a senior engineer in a power station in the UK. Both of them had rich individual views on CCFs' investment and operations in the UK's nuclear power programme. Two of interviews were conducted in respondents' working places, where respondents felt safe, comfortable and private. This adhered to Coventry University's research ethical requirements.

According to the aim of the case study's structured interviews, the interview questions were influenced with reference to the competitiveness framework (Appendix III). The respondents were asked to rate the important degree of key competitiveness indicators on a 5-point Likert scale based on the CCFs' performance in Hinkley Point C station, and they were required to give the reasons of each indicator's rating score.

2.5.2.3 Analysis of primary data

Both of quantitative and qualitative data required to analysis from the primary data.

Primary quantitative data

For quantitative data, SPSS software was applied to assess the consensus of the key competitiveness indicators from the Modified Delphi interviews. The position of consensus was required to be established at the start of the study (Crisp *et al.* 1997). Consideration must be given to the level of consensus employed (Hasson *et al.* 2000). To assess consensus, four sets of combined criteria measures would be used. This including (Geist 2010; Boyd *et al* 2014; Musa *et al*. 2015): characterised a median score of ≥4; a mean score of ≥3; the interquartile range (IQR) ≤1 or less and the standard deviation (SD) ≤ 1.0 on a 5-point scale. The mean score for each indicator was calculated, to provide an indication of the level of agreement amongst the panel members.

The standard deviation provided a measure of divergence, and, therefore, also gave an indication of the degree of consensus (Sumsion 1998; Boyd *et al*. 2014).

In order to test the level of agreement and stability, it was determined to abide by the ending criteria provided by Kendall's *W* coefficient of concordance. Kendall's *W* is one technique commonly used to test the level of consensus among expert panellists (Xia *et al.* 2009; Hallowell *et al.* 2011). The *W* value indicates the degree of agreement between the panel members by taking into account the variables between the rankings of mean involving different variables (Hon *et al.* 2012). The value of *W* ranges from 0 to 1, with 0 indicating no consensus, and 1 indicating perfect consensus.

However, this research applied 5-point Likert scale rating in the Modified Delphi interviews, thus, Kendall's W could not be directly applied in calculating the KCIs' ranking among participants. In this instance Ranking Average function in Excel was utilised to transform each respondent's rating scores of KCIs to the ranking positions. The rank average has proved useful when dealing with repeated values (Harkins 2011). It compares the number to its position in the list and it ignores values; behind the scenes it gives each duplicate a rank, and then finds the average for them (Treacy 2012). Table 2. 4 is a small example of rank average of an interviewee's ratings.

Table 2. 4: An example of rank average of an interviewee's ratings

KCIs	Mr C' rating in the first round	General Ranking	Ranking Average
KCI-1	5	1.00	5.50
KCI-2	5	1.00	5.50
KCI-3	4	11.00	13.50
KCI-4	3	17.00	18.50
KCI-5	4	11.00	13.50
KCI-6	3	17.00	18.50
KCI-7	2	21.00	21.00
KCI-8	5	1.00	5.50
KCI-9	5	1.00	5.50
KCI-10	5	1.00	5.50
KCI-11	4	11.00	13.50
KCI-12	3	17.00	18.50
KCI-13	4	11.00	13.50
KCI-14	5	1.00	5.50
KCI-15	3	17.00	18.50
KCI-16	4	11.00	13.50
KCI-17	5	1.00	5.50
KCI-18	5	1.00	5.50
KCI-19	5	1.00	5.50
KCI-20	4	11.00	13.50
KCI-21	5	1.00	5.50

Source: Author (2017)

From Mr C's rating scores, it can be seen that, many KCIs have the same rating score, for example, 10 KCIs were rated at score 5, these 10 KCIs could rank from 1 to 10 positions in the 21 KCIs, but they were ranked No. 1 in the general ranking because they had same value. Thus, a ranking average could be applied to calculate their average ranking position in all 21 KCIs. Thus, these ten KCIs' ranking averages are$=\frac{1+2+3+4+5+6+7+8+9+10}{10}=5.5$, this meaning these ten KCIs were ranked in the 5.5 position for all 21 KCIs. Similarly, six KCIs were rated as important as they score 4, but they were ranked No. 11 in the general ranking under the ten KCIs which were rated at score 5, but their ranking position could be as 11, 12, 13, 14, 15, and 16 in the 21 KCIs, therefore, these six KCIs' ranking average are $=\frac{11+12+13+14+15+16}{6}$ =13.5. By applied the same method, the four KCIs which rated as score 3, were ranked average at 18.5 in the 21 KCIs, the last one KCI-7 was ranked in No. 21 as its rating score was smallest. By applied a ranking average, it was possible to calculate each respondent's rankings for KCIs, and then the Kendall's *W* could be applied based on the ranking average to indicate the consensus among all respondents.

Schmidt (1997) proposed that Kendall's *W* offered the best measure of agreement in the application of the Delphi method; when $W \leq 0.3$ represented weak agreement, $0.3<W\leq0.5$ represented moderate agreement, $0.5<W\leq0.7$ represented good agreement, and $W>0.7$ meant strong agreement with respect to ranking. According to Kendall's *W*, $W\geq0.5$ revealed a fair degree of confidence in the results (Keil *et al.* 2002). It was common to conduct additional rounds to see if consensus could be improved further. However, in this study, a decision was made to rely on the results of the $W\geq0.5$, as Cafiso *et al.* (2013) and Musa *et al.* (2015) suggested that $W\geq0.5$ could be applied when the number of experts numbered over 30 in the research.

After the first round, the aggregate rating was calculated. The based thresholds for retaining indicator items were based on the combined criteria (median, mean, IQR and SD), and the level of agreement (Kendall's *W*) were assessed amongst participants in each round, retained only when indicators that satisfied these criteria wholly, and were considered to have reached consensus. The details of statistical analysis of Modified Delphi interviews data were analysed in chapter five.

In the case study, the primary qualitative data were directly applied in to the Weight Summation mathematical method $CV=\sum_{i=1}^{I} Wi*S(Ai)$ (chapter 7) to calculate the CGN's competitiveness score.

Primary qualitative data analysis

The primary qualitative data required an appropriate method to analyse them, in order to understand participants' opinions related to the issues of CCFs' global operations. The author

analysed the primary qualitative data following these steps. Both Modified Delphi interviews and structured interviews were the methods used to analyse qualitative data.

Step 1: Writing and reading transcript

The author listened to the audio recording and wrote the first transcript. In addition, the author repeated the reading of the transcript, it was very important for the author's understanding of the participants' views and enabled a researcher to focus on the richer and more detailed sections.

Step 2: Coding key competitiveness indicators

Smith *et al.* (2013:91) claimed that in looking for emergent themes, the task of managing data changed, as the analyst, simultaneously, attempted to reduce the volume of detail. Therefore, the author coded the KCIs based on the transcripts. For instance, the author's coding of the KCIs, which were mentioned in Mr T's answers are shown in Table 2.5.

Table 2. 5: Coding KCIs

KCIs	**Original transcript**
Human resource **Knowledge** **Local worker** **Productivity**	Author: In your view, what are the current issues affecting international and Chinese construction firms' entry into the overseas market? Mr T: First, human resource issues, some staff have professional knowledge, but they don't speak a foreign language and don't know how to manage local workers, this causes low productivity when we are doing a project.

Source: Author (2015)

Step 3: Assessment of the data to the open-ended questions

The last step involved the conclusion of the interview data based on the transcript and the coding of KCIs. This step has assisted the author in examining more closely every participant's real opinions about the interview questions. For example, in Table 2.3, when the transcript was analysed and the coding of the KCIs from Mr T's interview, the author understood that in his working experience, it was very important for a manager who could speak the local language not only English, because managers were required to communicate with local staff; the project's productivity could be affected if there was poor communications between managers and staff.

2.6 Limitation: Survivorship Bias

This research has focused on investigating the key competitiveness indicators, which drove Chinese construction companies successfully to respond to competitive global market changes. This incorporated an analysis of larger Chinese construction companies in the global market. The

data only reflect issues for these larger Chinese construction companies. Thus, the results of this research perhaps could not be applied to smaller Chinese construction firms which did not have permission to operate in the overseas market, or for those international construction firms which had different development issues when compared with Chinese construction companies.

2.7 Ethical considerations

Ethical Considerations can be specified as one of the most important parts of the research (Bryman and Bell 2007). Cooper and Schindle (2008) defined ethics as the norms or standards of behaviour that guide moral choices about our behaviour and relationships with others. Research ethics, therefore, related to questions about how the researcher formulated and clarified the research topic, research design, in order to gain access, collect data, process and store data, analyse data, and write up the research findings in a moral and responsible way (Saunders *et al*. 2009). Farrimond (2013) stated that the research principle had become enshrined in disciplinary codes; codes were sets of ethical rules which were designed to govern professional conduct. According to this principle, this research's ethical considerations adhered to the <Principles and Standards of Conduct on the Governance of Research, Document RC12/9> by Coventry University (2013), which provided the author with a statement of principles and procedures for the conduct of the research highlighting what was and what was not considered ethical.

All research should be conducted to the highest levels of integrity, including appropriate research design and framework, to ensure that findings were robust and defensible. Researchers should also adhere to the highest level of research ethics in line with requirements set out by national and international regulatory bodies, professional and regulatory research guidance, and research ethics framework issued in the appropriate area (Coventry University 2013).

Ethical issues during design and gaining access

Document RC12/9 (2013:4) noted: "*the questions being asked by the proposed research are appropriate and designed to add to whatever is already known about the subject in question or the methods for researching that subject*." Following this standard, the author designed the Modified Delphi interview questions based on the conceptual framework (Figure 4.8) and designed structured interview questions based on the competitiveness framework (Figure 6.6) and secondary literature. Document RC12/9 (2013:5) stated: *"…ensure that any research projects involving human participants, material or data complies with all legal and ethical requirements and other applicable guidelines and that research projects have been approved by all applicable bodies, ethical, regulatory or otherwise.*" The author submitted <Low Risk Research Ethics Approval> to Coventry University's Research Committee before primary data collection and have gained its approval. Following that the author contacted the participants through email and social

APPs (QQ and WeChat) to gain access for interviews. According to Robson (2002), the researcher should not attempt to apply any pressure on intended participants to grant access; participants had a right to privacy and should not feel pressurised or coerced into participating. Thus, in this stage, the author explained the purpose of the interview and research ethics in polite and respectful language to them, in order to achieve their participating agreement, because voluntary participation of respondents in the research process was important.

Ethical issues during data collection

Participants' safety and convenience and data reliability were two of ethical issues mainly considered during data collection. According to Document RC12/9 (2013), all research activities are carried out in premises which fulfil all requirements of current UK Health and Safety legislation and good practice. As Saunders *et al*. (2009) suggested, researchers should not ask participants to participate in anything that would cause harm or intrude on their privacy, where this went beyond the scope of the access agreed. Therefore, the author asked interviewees to select the interview locations, where they felt safety, comfortable and private. Therefore, the author interviewed Chinese experts, who worked outside the UK on video call via QQ and WeChat social software; and interviewed the UK experts in their private working offices. Moreover, in interviews, it would clearly be necessary to arrange a time that was convenient for participants (Zikmund 2000). The author asked participants to arrange a convenient time for interviews, and all interviews were booked through the participants' appointment.

Document RC12/9 (2013:7) noted: "*have in place procedures, resources and administrative support to ensure the accurate and efficient collection of data according to the agreed design of the research project and ensure it is stored on a secure and auditable form*." In adhering to this, before start to the interviews, the author first asked participants' agreement to record the interviews and explained research design, including the confidentiality and anonymity ethical issues to them. This meant making sure that data were collected accurately and fully. The importance of this action also related to the validity and reliability of research work (Saunders *et al.* 2009). In interviews, respect for the dignity of research participants should be prioritised and asking questions that were in any way demeaning to participants should be avoided (Sekaran 2003; Bryman and Bell 2007). The author politely and respectfully asked and discussed questions based on the research design with the participants, tried to avoid over-zealous questioning and pressing participants for a response, otherwise, it might have made the situation stressful for participants. With reference to Cooper and Schindle's (2008), they suggested, researchers should also make clear to interview participants that they had the right to decline to respond to any questions. Therefore, the author explained to the interviewees that they had the right to reject to answer questions, if they thought the questions were difficult. Such as in case study's structured

interviews, respondents rejected to rate and explain the important meanings of contract management, information management and information technology relating to CGN, because they considered that they lacked these indicators' details, and knowledge of the HPC project security issues involved.

Ethical issues related to analysis and reporting

The ethical issues of confidentiality and anonymity come to the fore during the analysis and reporting stage of research (Saunders et al. 2009). Document RC12/9 (2013:5) stated: "*ensure the confidentiality and security of personal data relating to human participants in research and of human material involved in research projects*." Therefore, the anonymity of participants was applied, and were named chronologically, as Mr A, Mr B and Mr C were the first, second and third participants who agreed to participate in this research, consequently, they were anonymous as A, B and C. Participants' company names were anonymous too, for example, the companies in the Top 100 firms were named as Ti (i=1, 2, 3...5), the companies not in the Top 100 firms were named as NTi (i=1, 2, 3…11). The scholar interviewees from universities were anonymous as Ui (i=1, 2…4). The two case study respondents' companies were named as Ci (i=1, 2). This research only revealed participants' positions in their companies (Appendix I). Therefore, participants' personal data were guaranteed confidentiality and security in this research.

Document RC12/9 (2013:9) stated: "*be aware that any misconduct in research is unacceptable and that anyone found to have committed misconduct in research will be subject to a formal disciplinary procedure to investigate allegations of misconduct*". Unacceptable conduct included each of the following: fabrication, falsification, plagiarism and misrepresentation (Document RC12/9 2013). Any type of misleading information, including representation of primary data findings in a biased way must be avoided (Bryman and Bell 2007). The author maintained the highest level of objectivity in discussions and in analyses throughout the research. All respondents' answers were correctly and honestly documented as transcripts based on the records. All the interviewees' rating scores were correctly input into SPSS for data analysis. The interview transcripts were sent to interviewees for confirmation in order to make sure their answers were exactly documented.

Moreover, acknowledgement of works of other authors used in any part of this research through the use of the Harvard referencing system was in accordance with the Royal Agricultural University Handbook.

Ethical issues associated with data processing and storage

Document RC12/9 (2013:7) stated: "*comply with all legal, ethical and organisational requirements for the collection, use and storage of data, especially personal data…Research data should be kept intact for any legally specified period and otherwise for at least three years from the end of the project*." All the interviews records and questionnaire results were securely saved in an electronic document with a password. These data were saved in the author's private computer for at least three years from the end of the project, only be used for this research, and not be shared with other people for another research topic.

2.8 Summary

This chapter explained the methodology design for this research. Both deductive and inductive approaches have been adopted in this research (Figure 2.3). In the following chapters, chapters three to four applied the deductive approach to gain an understanding of the notions of competitiveness theories and the development of global issues and China's construction market. Key competitiveness indicators were identified in global construction firms, in order to establish a draft conceptual competitiveness framework. Chapters five to eight utilised the inductive approach to investigate the KCIs, which contributed to Chinese construction firms' successful response to the changing global market, in order to refine, tighten, and validate the competitiveness framework.

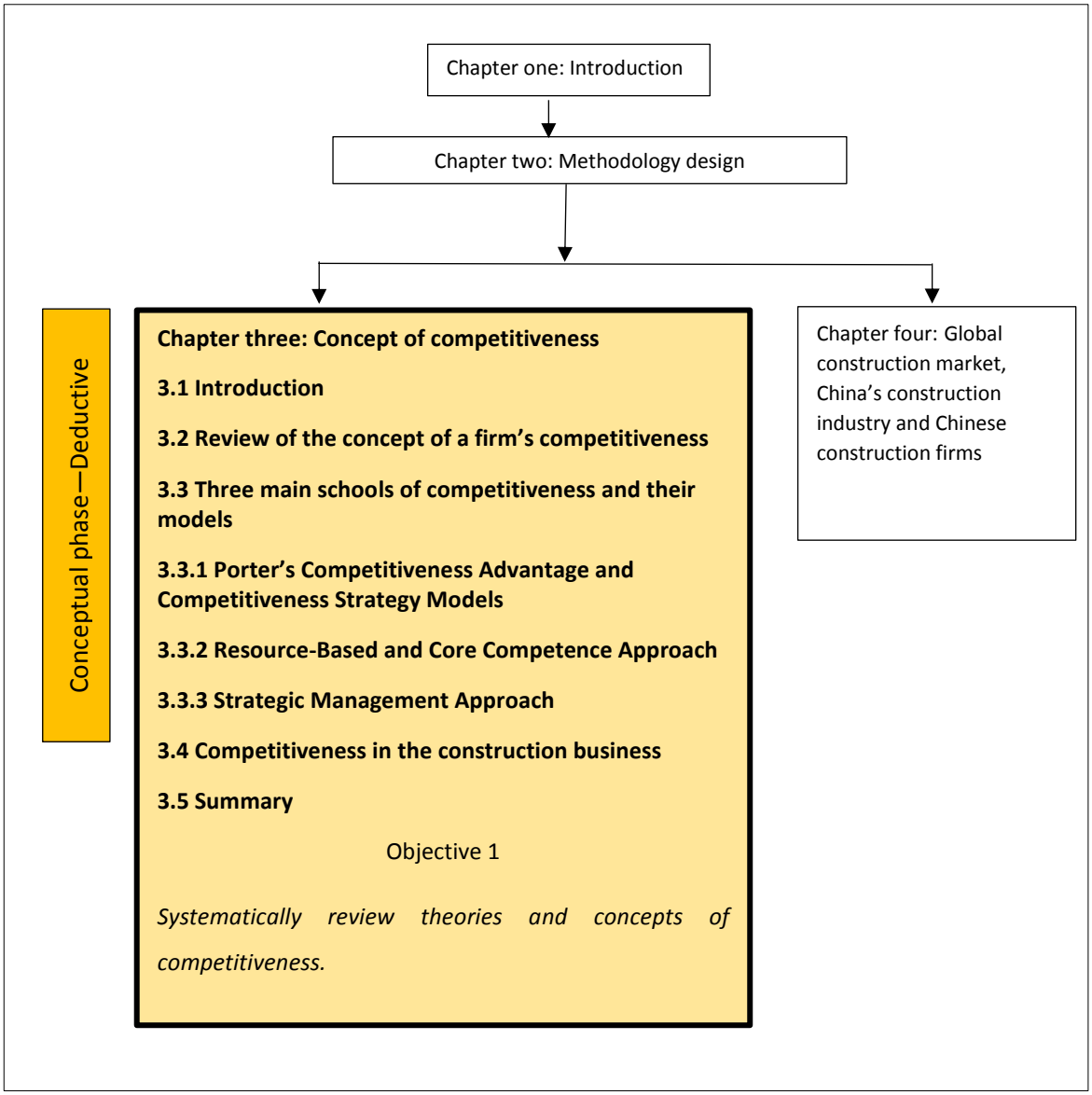
Sequential explanatory strategy is a popular strategy of mixed methods that has been adopted in this research (Figure 2.4). First, collection and analysis of quantitative data by secondary resources were employed in order to investigate which construction firms were key players in the global construction market. Secondly, collection and analysis of secondary qualitative data were assessed in order to identify KCIs. Following that, the collection and analysis of primary quantitative and qualitative data by interviews were undertaken.

The Modified Delphi interviews and structured interviews were selected as an appropriate approach for primary data collection. Because according to the research's aim and objectives, this study required knowledge from people who understood these complex issues. Thus, in Modified Delphi interviews, 14 experts were from the top 100 CCFs, and 14 experts were selected from other CCFs. In addition, two Chinese scholars and two UK scholars were selected as interviewees additionally in order to perceive their academic opinions about global construction companies' successful operations in the global market. In the case study structured interviews, two respondents were selected, one was selected from China's nuclear power firm, and the other one was selected from the UK's power company.

In the next chapter, the competitiveness theories and models are analysed through the systemic reviews of the secondary literature, in order to gain an understanding of the notions of competitiveness.

Chapter Three

A critical review of the concept of competitiveness



3.1 Introduction

The last chapter considered the methodology for this research. Both deductive and inductive approaches were adopted including a sequential explanatory strategy. A deductive approach was applied in the literature review in the conceptual phase to understand the theory of competitiveness and to identify the Key Competitiveness Indicators (KCIs) for assessing construction firms within the changing global market, thus, a draft conceptual competitiveness framework was proposed. Here, in this chapter, the literature concerning competitiveness theory has been analysed. According to the methodology design, this chapter has applied a deductive approach to analyse the concept of competitiveness through a secondary literature review.

Buckley *et al.* (1988) claimed that competitiveness could be examined from three different levels: that of the country, the industry, and the firm. Shen *et al.* (2004), however, considered that competitiveness could be analysed from four different levels: that of the country, the industry, the firm, and the project. As mentioned in section 1.2, this research investigated Chinese construction firms' international competitiveness at the level of the firm. Consequently, this chapter has conducted a literature review of a firm's competitiveness theory, in order to achieve the following aims:

1) Review the concept of competitiveness at the level of the firm
2) Understand competitiveness in the construction business

This chapter reviewed a body of the competitiveness data from three aspects. First, the general notion of a firm's competitiveness has been discussed. Second, this chapter reviewed three schools of competitiveness, to include: Porter's Competitiveness Advantage and Competitive Advantage, Resource-Based and Core Competence Approach, and a Strategic Management Approach. Third, this chapter reviewed issues of competitiveness in the construction business.

3.2 Review of the concept of a firm's competitiveness

"What is competitiveness?" is a straight question while debating the approaches for measuring competitiveness. In reality, almost every paper relevant to this topic has struggled with a definition. Lu (2006) noted that how competitiveness was measured depended on how it was defined, and how to improve competitiveness depended on the understanding gained into the concept.

Competitiveness is one of the influential and popular concepts in both economic and management areas (Lu 2006). It has long been discussed by classical and modern economists, including Adam Smith (1776), David Ricardo (1817), Joseph Schumpeter (1942), and Nicholas Negroponte (1995). The IMD World Competitiveness Centre publishes competitiveness reports annually to estimate the competitiveness of nations and industries. It has been attested by Porter

(1980) that competition played an important role for firms' success or failure in the market. Although researchers have been very productive in proposing their own competitiveness definitions, and have received extensive approval for its importance, but researchers have failed to reach a consensus on its definition. Since the 1960's, the achievement of competitiveness at a firm's level has received considerable attention, and has resulted in a fruitful body of literature (Flanagan *et al.* 2007).

A report on the select committee of overseas trade by Low (1985) claimed that a firm was competitive if it could supply products and services of superior quality, and at a lower cost than its domestic and international competitors; therefore, competitiveness was created by a firm's long-run profit performance and its ability to reward its employees and to provide superior returns to its owners. It suggested that a firm's competitiveness should focus on financial capability related to costs, prices, and profitability. But this definition had limitations, because it overlooked the fact that business management processes, including human resources, strategic management, and operation management could all affect a firm's competitiveness.

D'Cruz (1992) suggested that competitiveness could be defined as the ability of a firm to design, produce or market products superior to those offered by competitors, including price and non-price qualities. Johnson (1992), and Hammer and Champy (1993) considered the competitive process enhanced the ability of an organisation to compete more effectively. For providing customers with greater value and satisfaction than their competitors, firms must be operationally efficient, cost effective and quality conscious. These scholars paid more attention to an enterprise's ability to achieve greater value or profit. Weihrich (1982) presented a typical list of attributes affecting enterprise businesses, being classified as economic, social and political factors, management and finance abilities, markets and competition. But the relationship between a company and its customers was ignored.

Feurer *et al*. (1994) described competitiveness as a valuable relationship between organisations, customers, and shareholders. They suggested that an organisation make a profit in order to satisfy its shareholders and achieve continuous profit growth, which would improve its market position, as well as maximizing its potential for making greater profits to attract the necessary funds provided by its shareholders. It would be competitive in the views of customers if it were able to deliver better value when compared with its competitors.

Based on the literature review, Table 3.1 a selection of authoritative scholars' theories of a firm's competitiveness has been summarised.

Table 3. 1: A summary of firms' competitiveness definitions

Authors/sources	**Definitions of competitiveness**
David Ricardo (1817)	Comparative advantage is an economic theory about the work gained from trade for individuals, firms, or nations that arose from differences in their factor endowments or technological processes. In an economic model, agents have a comparative advantage over others in producing a particular good if they could produce that good at a lower relative opportunity cost or autarky price.
Joseph Schumpeter (1942)	The role of the entrepreneur as a factor of competitiveness, underlining that progress was the result of disequilibria, which favoured innovation and technological improvement
Alfred P. Sloan (1963)	The concept of management as a key input factor for competitiveness
Porter (1985)	At the firm's level, profitability, costs, productivity, and market share were all indicators of competitiveness.
Report of the Select Committee on Overseas Trade (1985)	A firm was competitive if it could produce products and services of superior quality and at lower costs than its domestic and international competitors. Competitiveness was synonymous with a firm's long-run profit performance and its ability to reward its employees and to provide superior returns to its owners
Buckley P.J. *et al*. (1988)	Firm's competitiveness includes reaching goals at the lowest possible cost and having the right goals. The choice of industrial goals was crucial.
Feurer, R and K. Chaharbaghi (1994)	Competitiveness was comparative and not absolute. It depended on shareholders' perceptions, customer values and financial strength, which determined the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes; competitiveness could only be sustained if an appropriate balance was maintained between these factors which could be of a conflicting nature.
Nicholas Negroponte (1995)	The concept of "knowledge" has been determined recently as the most important factor in competitiveness.
Invancevich, J. M., Lorenzi, P. and Skinner, S. J. (1997)	A firm could produce goods and services that met the test of international markets under free and fair market conditions, while maintaining or expanding the real incomes for its employees and owners.

Source: Author (2014)

It would be a daunting task to compile a comprehensive list of the definitions of firms' competitiveness, which have been detailed in the literature. In view of the fact that competitiveness had many diverse definitions. Porter (1998) stated that there was no strict definition of competitiveness. Lu (2006) stressed that the debate about competitiveness still persisted today. A universal and exact definition of competitiveness did not exist. Therefore, it was important to define competitiveness issues, because both the methods of understanding the

concepts of competitiveness and the nature of the factors influencing it were essential in identifying any competitiveness problems (Scott and Lodge 1985). The author agreed with their views that an explanation of competitiveness was necessary for exploring construction firms' competitiveness. Consequently, the above scholars' definitions of a firm's competitiveness would not be sufficiently flexible enough to apply at present. Nonetheless, these scholars provided valuable insights into competitiveness, but they considered industry in general, while the construction sector was characterized as being heterogeneous (Flanagan *et al.* 2007). Three dominant schools of competitiveness theory could provide a deep notion of competitiveness at a firm's level.

3.3 Three main schools of competitiveness and their models

Three main schools have dominated in the theories of a firm's competitiveness:

i. Porter's Competitiveness Advantage and Competitiveness Strategy Models (Porter 1980, 1985)
ii. Resource-Based and Core Competence Approach (Prahalad and Hamel 1990; Barney 1991)
iii. Strategic Management Approach (Chandler 1962)

3.3.1 Porter's Competitiveness Advantage and Competitiveness Strategy Models

Competitive Advantage (Porter 1980) and Competitive Strategy (Porter 1985) were the two main texts that outlined Porter's theory about a firm's competitiveness, which have received high approval, wide recognition and have been frequently applied by researchers since they were first published (Lu 2006).

Porter's theory of a firm's competitiveness has been considered as the industrial organisation's view of competitive advantage, which suggested that competitiveness derived from a firm's competitive strategy to reduce threats or to develop attainable opportunities in an industry (Vlachvei and Notta 2016). Porter (1980) investigated the major factors affecting competition for business internationally as opposed to nationally, such as cost differences, market differences, regulation differences and resource differences. By providing customers with greater value and satisfaction than their competitors, firms must be operationally efficient, cost effective and quality conscious. Superior value resulted through lower prices for equivalent benefits or differentiated benefits that justified a higher price (Porter 1985).

While it is considered impracticable to analyse in detail Porter's theory, Lu (2006:34) highlighted the major points of Porter's theory concerning a firm's competitiveness:

(1) A firm's competitive advantage derived from the competitive strategy it adopted

(2) The essence of a competitive strategy was to link a business with its environment

(3) However, a competitive environment for a firm is rooted in the underlying economic structure of an industry and went beyond the behaviour of current competitors

(4) More specifically, a competitive environment has been identified by a five competitive forces model

(5) In responding to the competitive environment shaped by five competitive forces, there were three generic strategies a firm could adopt: cost leadership, differentiation, and focus

(6) A firm that engaged each generic strategy but failed to achieve any of them has been termed as "stuck in the middle", and possessed no competitive advantage

(7) A firm must make a choice concerning which of the many generic strategies to adopt, and it was not feasible to pursue a variety of them

(8) A firm could be viewed as a collection of value activities

(9) The value chain could be considered an influential tool that enabled a firm to further elaborate the generic strategies for achieving competitive advantage, and

(10) Value activities were the foundations for a firm's competitive advantage

Porter theory suggested that the industry's characteristics determined its competitors, which the current competitors could not control, but a firm was required to find a position helpful to maintaining competitiveness (Porter 1980; 1985). However, one of the obvious limitations of Porter's competitiveness theory was that it did not address how a company should apply its internal abilities and mechanisms to adapt to the influence of a challenging external environment. This theory, evidently, overlooked the specific firm's competitiveness caused by managerial volition, organisational practice, reputation, and culture, which enhanced a firm's sustainable competitiveness (Lado *et al.* 1992).

Porter (1980) suggested that a firm's competitiveness arose from an industry's economic structure and beyond the behaviour of current competitors. The firms were concerned about the intensity of competition in an industry, with the five basic competitive forces determining the intensity of competition. In the context of this, the five competitive forces model, as shown in Figure 3.1, was proposed to analyse the competitive environment of a firm in terms of: threat of potential entrants, bargaining power of suppliers, bargaining power of buyers, threat of substitutes and rivalry among existing firms.

Figure 3. 1: Illustrates Porter's five forces model

Source: Porter (1980)

However, Porter's Five Forces Model had practical defects (Dälken 2014):

(1) It was difficult to gather complete information about a whole industry

(2) It assumed the existence of competitiveness in the same industry without partnerships. But in reality, many companies sought cooperation to achieve a greater market share

(3) Also, it assumed that an industry's scale was changeless; a company needed to seize its competitors' market share to acquire more consumers, and to achieve greater profits. In reality, companies that achieved a greater market shared benefits as did, consumers who profited through continuous development and innovation

Betts and Ofori (1992) and Langford and Males (2001) introduced Porter's model into the construction industry and indicated the availability of Porter's models in achieving competitiveness in the construction industry. Kale and Arditi (2002) applied Porter's theory to USA construction firms, and found that Porter's models were effective in the construction industry, however, Porter's theory still had limitation in practice, for example, USA construction firms could also achieve competitiveness even if a neutral strategy was adopted that fell between a narrow and a broad strategy, while according to Porter (1980, 1985), firms which adopted a neutral strategy, also identified as "stuck in the middle", possessed no competitive advantage.

It can be seen that Porter's five forces model was a theoretical tool, rather than a strategic tool for an actual operation. Therefore, it was important to develop a new model for an actual operation to perceive an analysis of competitiveness. This research applied Porter's theory to identify the KCIs, which revealed that Porter's theory clearly informed the drivers that contributed to a firm's competitive advantage regarding quality, risk management, organisational management, and cost. However, Porter's theory did not explain how a firm applied its precepts to its internal abilities when responding to a changing market. It showed a deficiency with respect to identifying competitiveness indicators relating to a firm's ability to respond to changes in market forces. Therefore, this research has attempted to solve these gaps in primary data collection and analysis in an exploratory phase (Chapter 5-7).

3.3.2 Resource-Based and Core Competence Approach

The Resource-Based and Core Competence Approach (hereafter Resource-Based Approach) moved the focus from an industry's structure to the resources developed by a firm (Lu 2006). In the Resource-Based Approach, Prahalad and Hamel (1990) proposed that firms should develop unique resources, and so core competence to sustain growth could be achieved.

One of the basic assumptions of Resource-Based Approaches was that an enterprise could be considered as a collection of resources (Penrose 1959). Resources included financial, tangible, and intangible resources (Dunning 1998; Douma and Schreuder 1998). Draft (1983) stated that resources referred to all the assets, capabilities, organisational processes, corporate attributes, information, and knowledge, which were organised by a firm to allow a firm to envisage and apply strategies.

Different opinions about a firm's resources have been expressed. For instance, Barney (1991) classified firm's resources as physical resources, human resources, organisational resources, and financial resources. However, Wernerfelt (1984) argued that a resource could be almost anything; it was significant to identify which resources could strengthen a firm's competitive stance.

In the view of Resource-Based Approach, an effective way for developing competitiveness was to identify and strengthen a firm's specific resources. Grant (2010) proposed that an analysis and achievement of a firm's competitiveness could be guided by the following steps: (1) identification of resources and capabilities in the firm; (2) assessment of the potential of the resources and capabilities in creating competitiveness; (3) determination of how to exploit the firm's resources and capabilities; and (4) identification of resource gaps, and to fill those gaps if the firm wanted to be successful in the future.

The main suggestions promoting the Resource-Based Approach were held by Lu (2006: 37):

(1) A firm can be viewed as a collection of resources

(2) Competitiveness depended on the resources inside a firm, not in the market and in industry structures

(3) Not all resources were necessary to be the sources of a firm's competitiveness; it was only the firm's specific resources that met the criteria of valuable, rare, non-substitutable, imperfect singularity

(4) A firm must identify and strengthen that firm's specific resources in developing its core competencies

(5) Usually, resources here referred to not only the possession of firm-specific resources, but also the effective application of those resources to achieve competitiveness.

The major contribution of the Resource-Based Approach is that it provided invaluable suggestions for a firm focusing on those firm-specific resources to achieve competitiveness.

Within the Resource-Based Approach, Momaya (2000) articulated a competitiveness framework, which identified categorised competitiveness indicators into three phases: Asset, Processes and Performance (APP) on the spectrum of strategic and operational levels. This could be of assistance to an industry's professionals and could support in the identification of firm's sources of competitiveness. See Figure 3.2 below.

Figure 3. 2: APP Framework

Source: Ambastha and Momaya (2004: 49)

The APP Framework illustrated the relationship between the source of competitiveness and the performance of a firm, focusing on price, quality, design, marketing, flexibility and management. However, it was important to recognise the role of dynamic processes in enhancing competitiveness and to examine the role of processes at the level of a firm's competitiveness (Ambastha and Momaya 2004).

This research understood that the main concept of a Resource-Based Approach was that by identifying and strengthening the core resources within a firm, a firm's competitiveness could be promoted. However, scholars still lacked agreement to identify a firm's resources, because resource could be almost anything (Wernerfelt 1984). The author agreed that a special resource could contribute to a firm's competitive advantage, but it was important to recognise which resources were valuable and, indeed, how to manage resources in such a way so as to sustain competitive advantage, which was a strategic consideration (Lu 2006). Moreover, a firm is required to understand the macro resource outside a firm, such as marketing regulations, and policy supports, these macro resource could be important for international businesses. Therefore, this research identified KCIs based on the Resource-Based Approach and would identify special macro resource from primary data for CCFs.

3.3.3 Strategic Management Approach

The initial thrust of Strategic Management was to deal with the turbulence of the business environment, and to encourage strategic discernment to achieve long-term development (Lu 2006). Organisations, and practitioners from every sector have focused on strategy as a primary topic at some point (Chinowskey 1999). Because strategic decisions involved principally "what shall we do?", by contrast, a strategic approach concluded "how should we do it?" (Langford and Males 2001). Thus, a strategic management approach dealt with a set of managerial decisions and actions that determined a firm's long-term performance (Wheelen and Hunger 2002). Buckley *et al.* (1988) noted the three categories of competitiveness measures: competitive performance, competitive potential, and management process. They considered both the tangible and intangible resources of firms' competitiveness. These included such areas as: finance, strategy, innovations, marketing, value creation and brand. Besides, in their research, competitiveness was considered as an ongoing process, rather than a static concept of other models. An organisation and its competitors constantly strove to match and improve their capabilities, offerings, and potential in order to increase the levels of customer satisfaction, shareholder value, and market share. Chinowsky and Meredith (2000) pointed out that seven areas needed to be considered with respect to a firm's strategic management: vision, mission and goals, core competencies, knowledge, education, finance, markets and competitors; they argued that technology, communication, and market advances were fundamentally changing the global perspectives of

time, distance, and spatial boundaries. Two decades ago organisations could identify themselves as local, regional, national, or international in scope. However, with the emergence of technological innovations, these boundaries have been blurred to the point where any organisation can theoretically participate in a business in any location. Concurrently, the concepts of company loyalty, traditional competitors, and employee development have changed at a pace that has not previously been encountered in post-industrial times (Chinowsky and Meredith 2000).

The Strategic Management Approach systematically reviewed competitiveness within strategy and operational management. However, in today's turbulent business environment, dynamic capabilities, flexibility, agility, speed, and adaptability were becoming important sources of competitiveness (Sushil 2000; Barney *et al* 2001).

SWOT analysis is one of popular competitiveness models in a Strategic Management Approach, it represented Strengths, Weaknesses, Opportunities, and Threats (Figure 3.3), which could be applied in the initial stage of strategic decision-making (Johnson *et al.* 1989). A Strategic Management Approach considered that change was an inevitable part of a community's organisation. If organisations knew how to assess the strengths, weaknesses, opportunities, and threats, organisations were more likely to plan and act effectively. SWOT could be considered as a tool to explore both internal and external factors that might influence an organisation's work, guide organisations in identifying their strengths and weaknesses, as well as broader opportunities and threats (Renault 2014). It provided the basic framework for strategic analysis (Baramuralikrishna and Dugger 1998). Organisations used SWOT to form strategies that fitted their particular situations, their capabilities and objectives (Adam 2000). SWOT Analysis was the most renowned tool for audit and analysis of the overall strategic position of the business and its environment. Its key purpose was to identify the strategies that would create a firm's specific business model that would best align an organisation's resources and capabilities to the requirements of the environment in which the firm operated (Ifediora *et al*. 2014).

Figure 3. 3: SWOT analysis

Source: Furgison (2015)

Renault (2014) noted that a SWOT analysis could offer supportive views at any stage of an effort. It might be used to: 1) Explore possibilities for new efforts or solve problems; 2) Inform the best method to decide a firm's initiative. Clarify direction and determine a firm's opportunities for success in the context of a threat; 3) Identify where change was possible. If a firm was at a critical stage, a list of a firm's strengths and weaknesses could reveal priorities and possibilities; and 4) Adjustment and improvement planning. A new opportunity might open up a wider path, and a new threat might close a path that once existed.

Johnson *et al.* (1989) suggested a SWOT application in a sequence of steps: 1) identification of current strategies, 2) identification of key changes in the organisation, 3) identification of the resource of the organisation, 4) establishing the strategies, as well as discovering the weaknesses against the context of key environmental concerns, and 5) the managers should then examine their SWOT statements compared with one another.

However, SWOT analysis is widely taught and seemingly intuitive, but it has come under serious criticism on theoretical grounds (Agarwal *et al.* 2012). Adam (2000) considered that SWOT analysis was often conducted in a way that did not allow appropriate communication, discussion and validation of all external and internal factors proposed by all interested parties. In this case, the results of the SWOT analysis demonstrated that the input to the strategy generation process was not reliable. Dealtry (1992) considered that starting with a list of current company's strengths, weaknesses, opportunities, and threats was essential to help develop an optimization strategy over a period of time. SWOT needed to modify this original inventory to reach a forecast that reflected the strengths, weaknesses, opportunities, and threats of the period. Baramuralikrishna and Duggar (1998) explained that SWOT helped determine what advantages an organisation

should build in the future, how the impact of weaknesses could be minimised, and what opportunities should be taken, and what threats needed to be confronted, but SWOT, as a simple framework, could not guarantee the necessary rigour of strategic analysis, and any expectations could be false.

Strategic Management was different from Porter's theory and the Resource-Based Approach. The latter two considered competitiveness as a static concept, but Strategic Management considered competitiveness as an ongoing process, a firm should be required to solve out "what shall we do?" and "how shall we do?" in order to improve its competitiveness. The KCIs were identified from Strategic management schools, such as: quality, social responsibility, corporate culture, and finance. However, the author considered that the Strategic Management Approach lacked the concept to indicate a firm's agility and adaptability for responding to the changing market. This gap would be addressed in the primary data collection and analysis (chapters 5-6).

From an analysis of the main schools of competitiveness theory and their models, the competitiveness indicators could be identified, such as quality, value-added for stakeholders, organisation management, risk management, and costs. However, as mentioned before, these three competition schools contributed to the understanding of notions of competitiveness, but they lacked the identification of indicators related to the responding ability with respect to the market, macro resource, and agility and adaptability. Therefore, a key question about competitiveness at a firm's level remained unanswered despite the rich literature on the subject, namely, how to adapt the frameworks for a particular firm at a particular stage of development with different capabilities and resources, such as, those developing firms (CCFs)? The author considered that the existing models and frameworks could not be applied or used in developing firms such as CCFs. It was deemed significant to develop a better framework to assess and improve competitiveness in the international market. In order to better understand CCFs' competitiveness in the global market, it was critical to review first the notion of a firm's competitiveness in the construction business.

3.4 Firm's competitiveness in the construction business

Achieving success must be a critical issue for companies to survive in a competitive business environment. The construction industry was also a strong competitive area owing to a large number of construction companies (Shen *et al.* 2006). Moreover, construction can be considered a risky business, and there always existed the possibility of business failure (Uher 1994; Hampson and Kwok 1997). The construction industry was constantly changing with the developments of new business methods and technologies (Han *et al.* 2010). Therefore, in order to survive in a competitive business environment, it was important that construction firms adopt applications and appropriate strategies to improve competitiveness and to achieve success in the construction

industry. At present, researchers have been focusing on key factors of success or failure in the construction industry. Management systems and practices were the two most important factors contributing to a company's success (Lussier 1995; Strischek 1998); additionally, accounting systems and regular review of financial statements (Gerstel 1991), onsite safety (Gordon 1997, quoted by Arslan and Kivrak 2008), and employees' continuing training and education (Bednarz 1997) were influencing construction firms' competitiveness. Holt *et al.* (1994) classified competitiveness indicators under five groups: contractors' organisations, financial considerations, management resources, past experience, and past performance. Hatush and Skitmore (1997) suggested a set of criteria categorised into five groups for assessing contractors' competitiveness, including: financial soundness, technical ability, management capability, health and safety, and reputation. Hutchings and Christofferson (2001) who researched residential construction companies in the United States, found that the competitiveness relating to a construction company were: quality workmanship, honesty, having good subcontractors, customer communications, reputation, having good employees, and completing projects on time. Shen *et al.* (2003) presented a comprehensive set of indicators relating to construction firms' competitiveness through development of a model for calculating a contractor's total competitiveness value (TCV), including social influence, technical ability, financing ability and accounting status, marketing ability, management skills, and organisational structure and operations. When Cheah *et al.* (2004) reviewed the financial performance of 24 different contractors; they found that there was no ideal global strategy; each company's strategy was dependent on the nature of the company and the markets they operated in. Henricsson *et al.* (2004) illustrated that for a construction industry, competitiveness referred to the ability to, in the long-term, to satisfy the sophisticated demands of companies, clients and society respectively and simultaneously, while acting under free trade and fair market conditions, and exposed to an international market environment. Arslan and Kivrak (2008) illustrated that conventionally, the traditional construction firm focused on the ability to plan, execute projects, cost, time, and quality. However, owing to the changing construction market, it was vital to focus on various factors relating to corporate success in order to be competitive in this environment. The European Commission (2012) published a Communications Strategy for the sustainable competitiveness of the construction sector and its enterprises. The document focused on the promotion of favourable market conditions for sustainable growth in the construction sector. Five areas were addressed:

(1) Financing: especially for energy efficient investments in the renovation of buildings and for research and innovation in a smart, sustainable, and inclusive environment

(2) Skills and qualifications: workforce and management training for job creation through up-skilling and apprenticeships were necessary to meet demands for new competencies

(3) Resource efficiency: focusing on low emission construction, recycling and valorisation of construction, and demolition waste

(4) Regulatory framework: emphasis on reducing the administrative burden for enterprises, and particularly small and medium-sized enterprises

(5) International competition: encouraging the uptake of Euro codes and promoting the spread of new financial tools and contractual arrangements in non-EU countries

Global construction firms are required to understand sustainable development of a firm's operations according to the European Commission's strategy, otherwise, they could not undertake projects in European countries.

However, Belohlav (1993) discussed that in many of the reviews on competitiveness and strategy was the issue of quality. He illustrated that high quality not only put a company on a much different competitive plane than its competitors, but also made a wider variety of strategic options available to the company. Because attaining high levels of quality created the potential to pursue not only a differentiation strategy, but also a low-cost leadership strategy within a market. Philips *et al.* (1983) showed that perceived quality and profitability were positively correlated. They concluded that the quality was the most important factor affecting business performance as the quality of an organisation's products or services relative to its competitors; in the short term, superior quality yielded increased profitability through premium pricing; in the long term, superior or improving quality should result in increased market share. Greenan *et al*. (1997) found that relative to competitors, high-growth companies were more likely to sell higher or higher quality products than low growth companies. This definition of quality held the key to the proper place in the strategic planning process of an organisation. Buzzell and Gale (1987) demonstrated clearly that higher relative quality was a strong driver of return on investment. Conversely, high levels of quality were not necessarily synonymous with being successful or even in formulating good strategy. The quality perspective provided the basis for strategic advantages. If an industry was in decline or there was a poor economic environment, just possessing high quality might not be enough to maintain competitiveness or even profitability.

Nevertheless, Uher (1994) stated that the costs were main factors of competitiveness in the construction business, because cost was the prime factor in the traditional tender selection process. The main reason for applying competitive bidding was that customers had a right to achieve best value (Smith 1986; Latham 1994), and required the selected construction firms to

complete its project in order to abide by the contract requirements (Palaneeswaran and Kumaraswamy, 2000). Since Friedman (1956) published his paper: "A competitive bidding strategy", the area of competitive bidding in construction has been researched. The dominant mechanism in competitive bidding exercises determined that lowest-price won. The mechanism was considered as effective, because traditionally, the functions of the project were pre-designed, and the quality of a project was mainly an extension of the regulations or contracts (Lu 2006). Palaneeswaran and Kumaraswamy (2000) argued that a low bidding approach only could only be adopted when the project's scope was very tight, clearly defined and did not need innovation. Table 3.2 has summarised a sample of researchers' opinions of lowest-price mechanism won based on the literature review.

Table 3. 2: A sample of attitudes of researchers concerning bidding prices

Source: Author (2015)

In the global construction market, different countries had different approaches to select an appropriate construction company in the bidding phase. A study by Marzouk, *et al.* (2013), who investigated different countries in the approach for bidding, is shown in Table 3.3.

Table 3. 3: Approaches for selecting construction firms in bidding phases in different countries

Source: Marzouk, *et al.* (2013:151)

The Table 3.2 and Table 3.3 above suggested a low bid price was a key factor to win projects in the bidding phases. However, Latham (1994) considered that the lowest price bidding mechanism was very disappointing. This was especially true of highly complex construction projects, which required innovation and strong financial capability. Researchers stated that focused on bidding price could cause poor quality and prolonged construction duration (Drew and Skitmore 1997; Shen and Song 1998; Cheng *et al.*2000), and contributed to ruining the sustainable development of the entire industry in the long term (Fu *et al*. 2003).

Hatush and Skitmore (1998) believed that the acceptance of the lowest price in bid evaluation was the prime reason for project delivery problems, as contractors desperately quoted low prices by reducing the quality of their work and hoped to be compensated by submitting subsequent claims. Fong and Choi (2000) pointed out that the majority of current bidding methods over-emphasized acceptance of the lowest bid; there should be a trade-off between cost, time and

quality in the final selection of a contractor. Wong *et al.* (2000) considered that the lowest-price was not an encouraging approach to attain the overall lowest project cost upon project completion, multi-criteria selection should become more popular. Shen *et al.* (2004) adopted the concept of competitiveness to embody the performance of bidding evaluation based on multiple criteria. They argued that competitiveness encouraged the integration of various aspects of competitive bidding, and construction contracts should be granted on the basis of a contractor's overall competitiveness in order to ensure the overall success of a project.

Several seminal researches on competitiveness in bidding existed. Marzouk *et al.* (2013) asserted that there were other criteria, which should be taken into consideration, the main objectives of the bidding were to reduce project risk, maximize quality and maintain a strong relationship between project parties. Flanagan and Norman (1982) suggested that bidding was not only affected by price but also by the type of project concerned. Because project clients had different priorities based on various project objectives, contractors must have different capabilities with respect to different types of projects. Therefore, the project type should also be considered when contractor competitiveness is examined (Shen *et al.* 2006). Fong and Choi (2000) used a sample of 13 respondents to identify and prioritize eight uncorrelated competitiveness indicators in bidding: tender price, financial capability, past performance, past experience, resources, current workload, past relationships, and safety performance for contractor selection. In a study by Darvish *et al.* (2008), the multi-criteria decision making method was used, taking into consideration the following criteria for selection: technology and equipment, management, experience and knowledge of the technical staff, financial stability, and quality, being familiar with the area or being aware of domestic issues. Marzouk *et al*. (2013) identified important factors in a survey, which was conducted with 29 experts in the construction field. They illustrated that price could be the sole criterion based on which selection procedure was adopted by a contractor who wished to maximise profits. However, high quality work backed by strong technical skills and a cooperative attitude was considered among the best options. The important factors identified by Marzouk *et al.* (2013) were mixed: flexibility and cooperation when resolving delays, reputation, delays, failure to comply with the quality specifications, quality, suppliers' incompetency to deliver materials on time, failure to complete contract, physical resources, tender prices, a contractor's difficulty in respect of reimbursement, flexibility in critical activities, and safety consciousness on the job site.

The literature on construction competitiveness illustrated that while the lowest bid price was one of the most heavily weighted criterion in bidding (Holt 1998; Doloi 2009), successful projects also called for a construction firm's capability in delivering optimal operational performance over the project's life cycle (Akintoye *et al*. 2003).

3.5 Summary

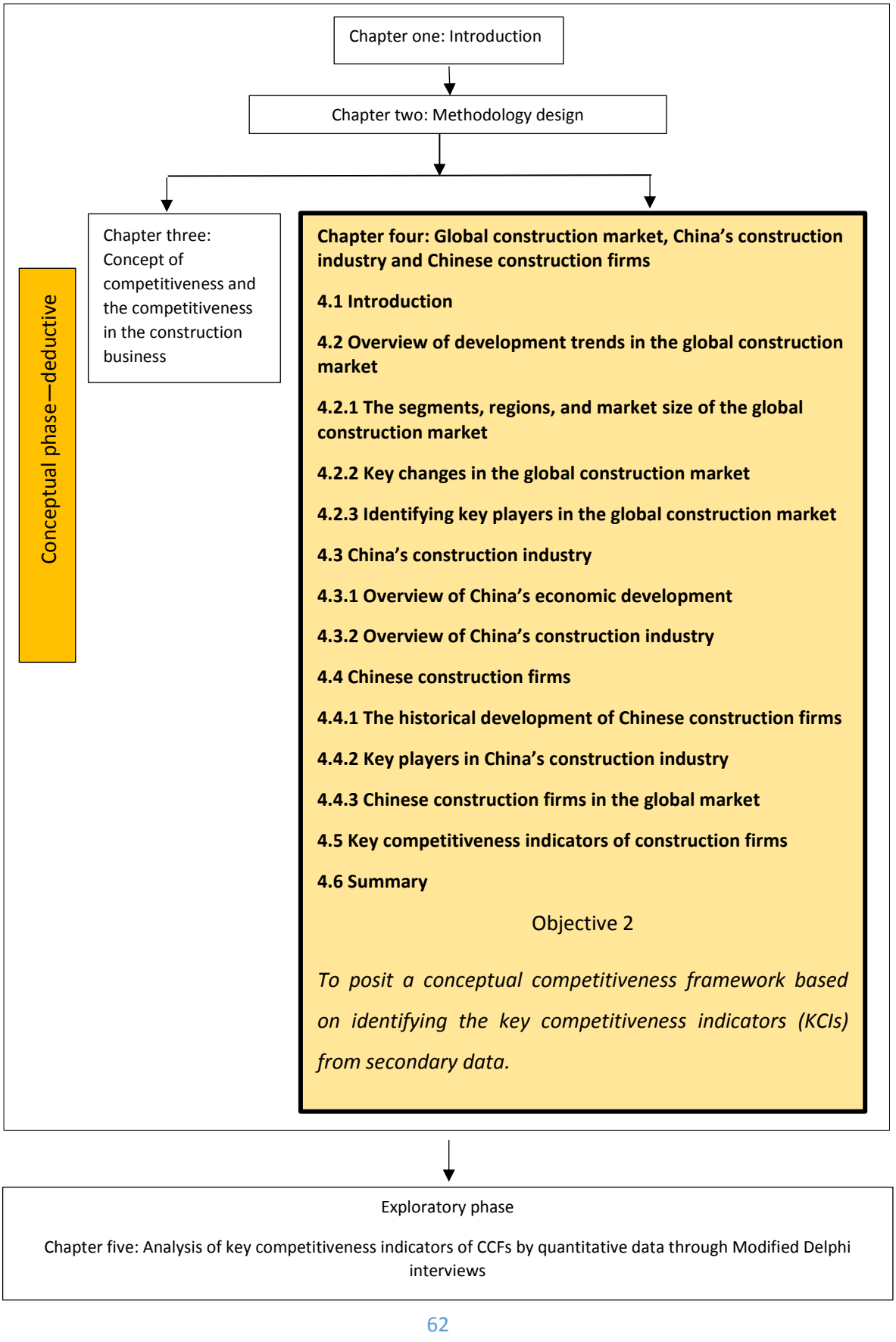
This chapter critically reviewed the notions of competitiveness theory and competitiveness in the construction business through secondary literature; the two aims of this chapter were achieved. Competitiveness was the core of a firm's success or failure in a turbulent business environment. Improving competitiveness was the critical approach for a firm surviving in the market and successfully competing with their rivals. There were three main streams of competitiveness theory dominant, all have contributed to an understanding of the theories of competitiveness at a firm's level. Porter viewed a firm's competitive advantage derived from a firm's strategies to operate in the competitive market. The Resource-Based Approach regarded the firm as a collection of resources, and a firm's specific resources were sources of competitiveness. The Strategy Management Approach considered that a firm was required to improve strategic management to achieve competitiveness in a turbulent market. However, although researchers' widespread approval of the importance of competitiveness, and have been fruitful in proposing their understanding of the term, they have failed to reach agreement on its definition.

Many scholars have researched competitiveness in the construction business (for example: Fong and Choi 2000; Shen *et al.* 2006 and Marzouk *et al.* 2013). Existing literature has provided various concepts of construction firms' competitiveness. Much of the literature considered quality and bidding were the two of most important factors affecting construction firms when undertaking a project. High quality was a strong driver, and contributed to construction firms' competitive advantage. But, just to pursue high quality might not be enough to maintain competitiveness, because many factors affected a construction firm's competitiveness, such as, finance, on-site safety, education, technology, quality and bidding. In many countries, a lowest-price policy has been the principal mechanism in competitive bidding. However, a lowest bidding policy could result in poor quality and prolonged construction duration problems. Thus, construction firms must strive to overcome the lowest bidding policy to win projects, sustainable competitiveness required they should improve firms' competitiveness in comprehensive aspects, such as business strategy, organisational management, and financial capability.

All these insights from the general competitiveness theories and the construction industry were considered fruitful, while, gaps in the literature on competitiveness and the global operation of Chinese construction firms required further research. In the next chapter, the global construction market, China's construction industry and the Chinese construction firms have been analysed. Moreover, the key players were identified from the *"Top 250 international contractors"* by the Engineering News Records' annual ranking over the past decades. Thus, the key Competitiveness Indicators (KCIs) will be identified by the key players' reports and academic papers. Finally, a draft conceptual competitiveness framework has been proposed.

Chapter Four

The Global construction market, China's construction industry and Chinese construction firms



4.1 Introduction

The previous chapter investigated competitiveness theories through a review of secondary literature. There were three dominant theories of competitiveness: Porter's theory, a Resource-Based Approach, and a Strategy Management Approach. These theories have facilitated an understanding of competitiveness at a firm's level. Project quality and bidding competitiveness were two of the most important factors affecting construction firms undertaking a project. However, either quality or lowest bidding were not considered enough to maintain competitiveness. In the turbulent global markets, many issues could affect a firm's competitiveness.

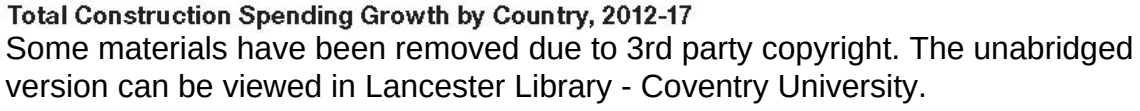
This chapter has investigated some issues in the global construction market, the evolution of China's construction industry, including the characteristics of Chinese Construction Firms (CCFs). This chapter has drawn on secondary literature and published data from the World Bank; Information Handling Services (IHS) Global, which have provided information and analysis to support the decision-making process for businesses and governments in industries; with further contributions from Engineering News Records (ENR); Global Construction Perspectives and Oxford Economics, and China's Statistical Yearbook (CSYB). Five key questions emerged:

1) What were the development trends and change issues relating to the global construction market?
2) How has China transformed its economy and developed its construction industry?
3) Who were the key players in the global construction market and China's construction market?
4) What was the CCFs' competitiveness in the global construction market?
5) What are the Key Competitiveness Indicators (KCIs) of construction firms?

4.2 Overview of the development trends in the global construction market

Construction is regards as a major industry throughout the world (Crosthwaite 2000). Global Construction Perspectives and Oxford Economics (2009) predicted that construction in emerging markets would double in size over the next decade, growing by an estimated 110% to become a $7 trillion market, representing a massive 17.2% of GDP by 2020. It was also indicated that Eastern Europe, led by Russia and Poland, would average growth of over 100% over the next decade. IHS Global (2013) indicated that global construction spending slowed slightly in 2013, owing to the global economy faltering in 2013 as a result of the political uncertainty in the United States and a slowing of growth in China that heightened caution in those countries and spilled over to their trading partners. Nevertheless, global construction spending would increase in all regions and all sectors from 2014 (Figure 4.1).

Figure 4. 1: Prediction of total construction spending growth by country from 2012-2017



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Source: Global construction outlook: Executive summary (IHS, 2013:1)

Figure 4.1 showed that construction spending would grow mainly in Asia, Northern America, Northern Europe, and Africa, owing to the Chinese government's reinvigoration of overseas infrastructure programmes and Northern European countries' emergence from recession resulting in brighter prospects for growth (IHS 2013).

The increasing international construction sector could also be supported by the ENR's annual statistics that have shown that Top 250 International contractors have increased their revenue from international construction contracts in global markets over the last decade. A comparison of the top 250 international contractors over the past decade has revealed that revenue generated by these firms increased from US$167.2 billion in 2004 to US$521.5 billion in 2014, but decreased by 4.1% from $543.8 billion in 2013 because of a fall in oil prices (ENR 2005-2015). The drop in oil prices were definitely beginning to impact on international contractors in that sector in 2014. For example, Technip announced that the oil-and-gas market was under pressure and that it foresaw even greater challenges ahead. To address these challenges in its core market, Technip declared that it was planning to introduce cost-cutting measures to save $925 million in expenses over the next two years, including the elimination of 6,000 workers worldwide, and by optimising its asset base (ENR 2015). It can be seen that the global construction market was growing rapidly, although it was affected by the drop in oil prices in 2014; construction firms could still gain market share by improving their competitiveness in response to changing global market conditions in the future. Additionally, growth in the global construction market required construction firms to enhance their competitiveness to improve business prospects in the

international market. The global construction market's segments, regions, market size, key changes, and key players have been analysed in the next sections (section 4.2.1-4.2.3), in order to recognise the development and changing issues in the global market and to understand reasons that CCFs were required to improve their international competitiveness.

4.2.1 The segments, regions and market size of the global construction market

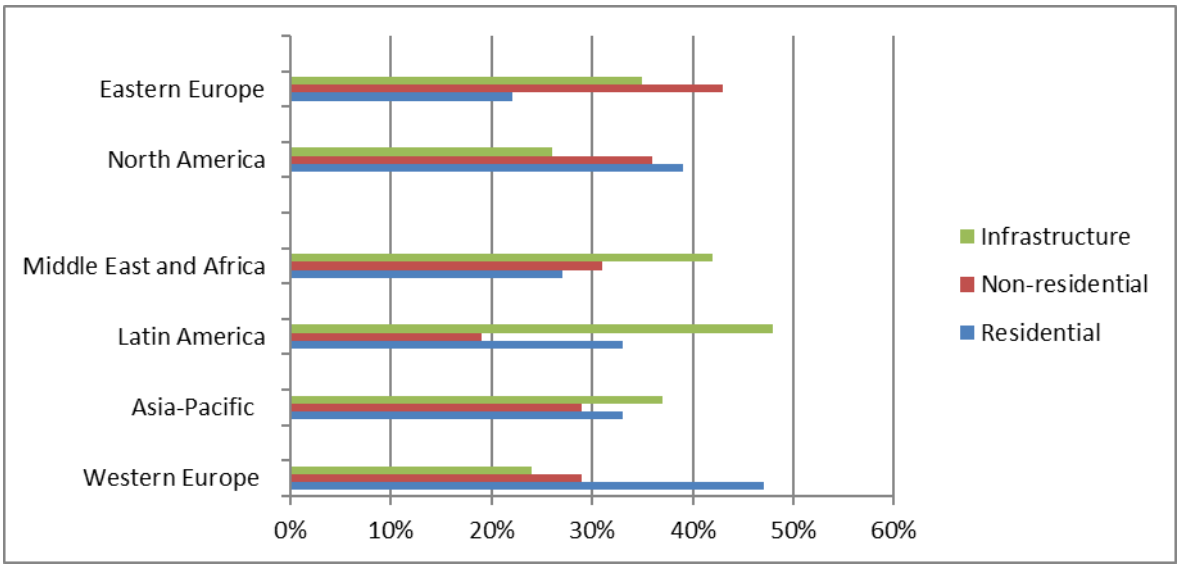
The Global Construction Outlook by IHS Global (2013) broke the construction market into three segments: residential, non-residential and infrastructure (Table 4.1 and Figure 4.2).

Table 4. 1: Global construction segment details

Source: Global construction outlook: Executive summary (IHS 2013:4)

All segments within the global construction market increased by 2.4 % in 2013, and an increase by 3.8% of compound annual growth rate (CAGR) from 2012 to 2022 has been forecast. Infrastructure constituted the main segment in the global construction market, which had forecast a growth by 4.2% of CAGR by 2022, although its market size was smaller than the residential in 2013.

Figure 4. 2: The segments of the global construction market by region in 2012



Source: Author's compilation from the Global construction outlook: Executive summary (IHS 2013)

Residential construction was the main business for construction firms currently, especially, in developed regions such as North America, and Western Europe. Whilst infrastructure accounted for more market share in developing countries, in regions such as the Middle East, Africa and Latin America. Non-residential and infrastructure CAGR would respectively increase by 3.7% and 4.2% by 2022; exceeding residential CAGR by 3.6%, would become the major business in the global market, as governments reinvigorated stagnant economies, particularly, in China and Japan, by means of investment in infrastructure construction (IHS 2013).

Eastern Europe

Eastern European construction spending declined by 4.9% in 2013 (IHS 2013), and also saw a double-digit decline, dropping by 10.4% in 2014 (ENR 2015). But the region's construction spending would be stimulated as the global economy recovered and demand for Eastern European exports would be reinvigorated (IHS 2013). Russia would continue to dominate the region's construction activity during the next five years, although smaller countries such as Romania and Hungary would begin to enjoy healthy construction growth as exports picked up once the Eurozone economies stabilized (World Bank 2015).

North America

In 2013, construction spending in the United States was up by 4.4% led by the residential sector (IHS 2013). The United States' market showed a rise of 5.7% to $51.15 billion in 2014; but the international contracting market in Canada suffered the biggest setback, falling by 13.5% to $29.58 billion (ENR 2015). In Mexico, total construction spending declined slightly with decreases

in the residential and infrastructure segments. It was expected that North American construction spending would enjoy a healthy growth through 2017 with chemical manufacturing, residential, and office construction being prominent (IHS 2013).

The Middle East and Africa

Construction spending in the Middle East and Africa increased by 3.8% in 2014, and total construction spending in this region was thought to increase at a compound annual rate of 3.7% through to 2017 (IHS 2013). The South African government has committed to spending US$109.74 billion on infrastructure development through to 2015, including the construction of power plants, transportation network expansion and upgrades, and new water and sanitation systems. A lack of infrastructure has constrained South Africa's ability to grow its export sectors. As a result, infrastructure would see the fastest growth and residential construction would be the slowest-growing segment in Africa (IHS 2013).

On a regional basis, Africa showed the highest gains with respect to international revenue from projects in Central and Southern Africa, growing by 14.7% in 2014 (ENR 2015). However, many major international contractors worried that the presence of substantial amounts of Chinese financial aid, and large numbers of Chinese contractors in Africa would make it a potentially tough and difficult market to compete in.

Most countries in the oil-producing Middle East region have already invested in massive social and infrastructure projects. There was a concern because the decrease in oil prices might cause a decrease in housing and other construction projects (IHS 2013). One new development in the Middle East was the growing use of Public-Private Partnerships (PPP) to help finance projects. PPP and Build-Operate-Transfer (BOT) schemes were increasingly popular, especially for large infrastructure projects, as the cost of funding for such projects increased (ENR 2015).

Latin America

The construction market was increasing in Latin America as its trading partners recovered. The Asian Infrastructure Investment Bank (AIIB) (2015) indicated that the region had enjoyed investment from Asian countries, particularly China, which had been willing to fund infrastructure development in the region in return for access to its natural resources. Brazil possessed the largest construction market in Latin America. Infrastructure was also driving construction spending growth in Colombia, where the government had launched a plan worth US$25 billion for the development of 47 projects before 2020 (IHS 2013). The rapid development of shale oil and gas and other scarce hydrocarbon supplies in North America would serve to moderate global

energy prices, making it more difficult for Latin American countries to attract investors interested in developing the needed infrastructure (World Bank 2015).

Asia-Pacific

Growth in construction spending in the Asia-Pacific region slowed to 5.8% in 2013, as spending increases in China dipped to 5.4% (IHS 2013). ENR (2015) pointed out that infrastructure construction would remain the primary contributor to China's growth and would accelerate from 7.4% growth in 2013 to 10.3% growth in 2014 since the government's initiatives to support growth via stimulus continued to revitalize infrastructure projects. Owing to the housing bubble's adverse effect on spending in residential construction, the Chinese government has shifted to a growth-support policy that has reinforced a rebound since mid-2013. This policy shift has reinvigorated investment in infrastructure, stimulating construction spending in that sector. The Chinese market has been difficult for international firms, and the country's economic situation was making it even more problematic. The huge growth in Chinese construction companies has seen further intense competition in an already crowded market space. In addition, India's five-year plan has been lowered as the government struggled to achieve a political majority necessary to pass much needed economic reforms (IHS 2013).

Western Europe

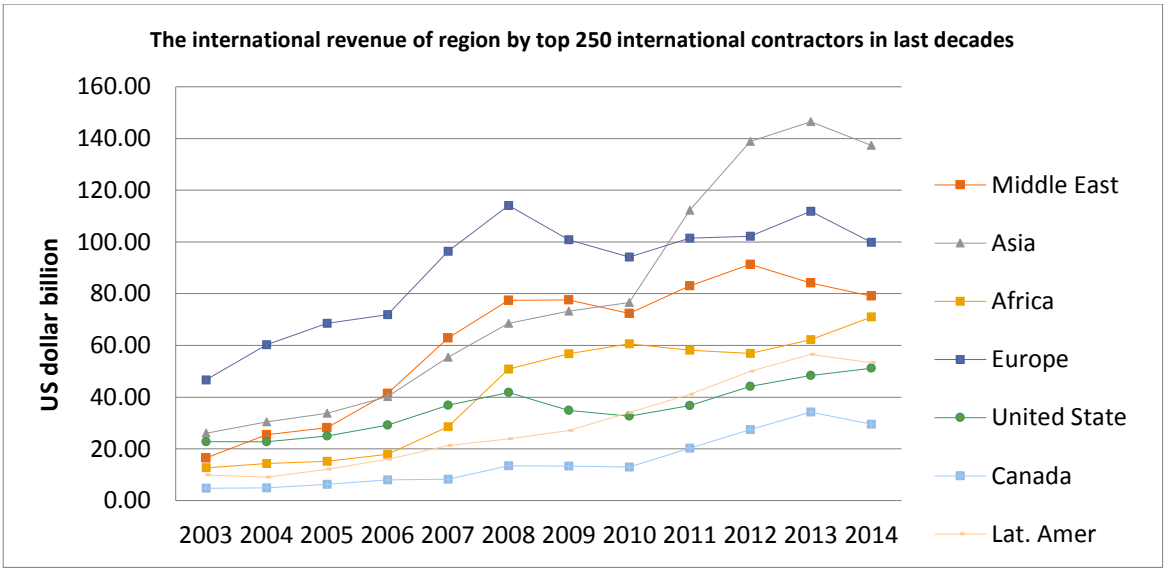
All segments of construction in the Western European region experienced a decline in spending in 2013 (IHS 2013). The turnaround in the residential segment would be less strong than the resurgence in non-residential structures and infrastructure segments as the region felt the effects of the housing bubble collapse.

In Europe, the French market was recovering after falling sharply, and both private and public projects were increasing (ENR 2015). The Grand Paris metro programme could generate $11 billion of rail work over the next decade. Many large European contractors believed that infrastructure projects would bolster the market. European Commission President Jean-Claude Juncker has proposed the creation of a fund to guarantee infrastructure projects that might stimulate $330 billion in projects over the next five years. This would prove to be a positive influence on core markets, especially in regions with high refurbishment needs in the infrastructure sector (ENR 2015).

The increasing construction business in each region could also be supported by the ENR's annual statistics. Figure 4.3 has illustrated that the trend of international construction revenue by the top 250 international contractors in every region has increased over the last 10 years. The important markets were Asia, Europe and the Middle East, those that have had significant positive growth

from 2006. In Figure 4.3, the Asian market exhibited a significant growth rate from 2010 to 2013, being valued at 1.91 times its pre-defined value in 2010, which revealed the Asian construction market had a higher value than its European equivalent.

Figure 4. 3: The international revenue by region of the top international contractors from 2004 to 2015



Source: Author's compilation from top 250 international contractors (ENR, 2004-2015)

While the construction has been increasing in each region, risk existed in the construction market. IHS Global (2013) researched construction growth rates and risks in a total of 69 countries. It was discovered that among the 15 largest construction markets, China, India, Indonesia, Brazil, and Russia had construction risk scores higher than the average score for the other 69 countries. Of this group, China had the highest risk level while China has always stood out with growth prospects owing to industrial production gains and a rapidly increasing rate of urbanization, nonetheless, construction investment in the country would also slow as the Chinese economy matured and growth would begin to slow. The United States had the second-largest construction market with low risk, with respect to growth that was expected to be above average over the five-year period (Table 4.2). The risk score was based on market factors that were geared towards more long-term investment situations. These factors included the transferability of funds, the cost of construction materials, the enforceability of contracts (both government and private), the losses and costs as a result of physical corruption or physical hazards, the risks of increased regulations (applying to both environmental and import-related), as well as currency depreciation, wages, corporate income taxes, import taxes, and risks relating to skilled labour shortages.

Table 4. 2: The 20 Largest growing markets with risk scores

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Source: Global construction outlook: Executive summary (IHS Global 2013:27)

Sections 4.2.1 displayed that the global construction market had been affected by a drop in the oil price in 2014, but for all regions the construction market was expected increase over the next decades, especially, in the infrastructure sectors as many countries' governments stimulated the economy's growth through the development of infrastructure construction spending. This meant that the global construction market had many business opportunities for construction enterprises. This required construction firms to improve their competitiveness to meet the demands of the global construction market. However, risk existed in the global construction market, especially the largest growing market, such as China, Russia, and Indonesia; thus, construction firms needed to improve competitiveness concerning risk management to identify, assess and solve risks in the market. With the rapid development of global construction market, some factors could be changed, which could affect construction firms' international operations.

4.2.2 Key changes in the global construction market

Many scholars have considered that some factors could be changed, which would affect international firms' expansion overseas in a dynamic global construction market. Mahalingam *et al*. (2005) deliberated whether overseas countries or clients paid more attention to project financing, or the level of technology, or a foreign firm's advanced experience, knowledge, and management skills. These elements required contractors to be capable of managing many dimensions of construction projects, including design, engineering, procurement and construction. Han *et al.* (2010) considered that the uncertainty and dynamic changes surrounding global construction posed serious threats to global contractors; they pointed out that the international construction industry had changed dramatically in many ways, including: the terms of competition rules and delivery systems for the selection of contractors, financial resource diversity, key products, and new emerging markets. Zilke and Taylor (2014) considered that the global construction industry has been influenced by many changing factors: finance, competition, regulation and political conditions. The key changes in global construction have been summarised in Table 4.3.

Table 4. 3: Key changes in global construction market

Source: Han *et al.* (2010)

Table 4.3 identified that the competition paradigm had shifted from conventional price competition to a more complex competitive framework where non-price factors were more critical. Even when considering the lowest-bid opportunities, more clients were evaluating a contractor's ability to offer additional services such as technology transfers and risk protection for owners. Secondly, the steady rise of private investment schemes and the growing size of projects, delivered in the form of integrated schemes, required more capabilities encompassing the entire phase, including planning and development, financial structures, engineering, procurement, and construction. Thirdly, financial capability played a key role in acquiring more opportunities in the international construction market, as more overseas construction projects required financial arrangements as part of providing services for owners.

The development and changes in the global construction market have been investigated in much of the literature. It was essential for international construction firms to understand the key changes in the global construction market. International construction firms needed to adjust their operation management abilities to improve their competitive position in the global construction market.

4.2.3 Identifying key players in the global construction market

Based on the ENR ranking of the "*Top 250 international contractors*", key players could be identified in international construction markets. The top 250 international contractors were

ranked by construction firms' annual international revenue that was generated by overseas projects. This research focused on the Top 100 global construction firms over last 10 years. A total of 182 global construction firms have ranked in the Top 100 over the last 10 years by their international revenue (see appendix IV), with 155 international contractors and 27 Chinese contractors. In 2015, 21 CCFs have been ranked in the top 100. However, 34 European construction firms were ranked in the top 100 (Table 4.4), their strong competitiveness could be seen from their international revenue, especially, European construction firms which were ranked in the top 10 International Contractors (Table 4.5). In the Top 10 international contractors, seven European, two United States companies and one Chinese company were ranked. It could, thus, be identified that European construction firms were key players in the global construction market.

Table 4. 4: Top 100 international contractors by countries

Source: Top 250 international contractors (ENR 2014, 2015)

Table 4. 5: Top 10 global construction firms

Company name	Country	Rank		International Revenue ($ MIL)		Total revenue ($ MIL)		International revenue accounted %	
		2014	2013	2013	2012	2013	2012	2013	2012
Grupo ACS	Spain	1	1	44,053.8	42,772.0	51,029.3	50,654.6	86.33%	84.44%
HOCHTIEF AG	Germany	2	2	34,845.0	34,563.3	37,012.8	36,452.7	94.14%	94.82%
Bechtel	U.S.A.	3	3	23,637.0	23,255.0	30,706.0	29,436.0	76.98%	79.00%
VINCI	France	4	4	20,292.6	18,419.5	54,107.0	50,338.7	37.39%	36.59%
Fluor Corp	U.S.A.	5	5	16,784.3	17,209.6	22,144.1	22,352.8	75.80%	76.99%
STRABAG SE	Austria	6	6	15,392.0	16,062.0	18,023.0	18,557.0	85.40%	86.55%
BOUYGUES	France	7	7	14,789.0	14,196.0	35,993.0	33,885.0	41.09%	41.89%
Skanska AB	Sweden	8	9	14,141.1	13,291.6	18,446.5	17,217.0	76.67%	77.20%
China Communications Construction Group.	China	9	10	13,162.5	11,187.2	54,181.7	47,327.3	24.29%	23.64%
Technip	France	10	11	12,243.0	10,347.0	12,399.0	10,547.0	98.74%	98.10%

Source: Author adapted from Top 250 international contractors (ENR 2013-2014)

Table 4.5 identified that CCFs' lack of an element of international competitiveness in their international revenue. For instance, in 2014, China Communications Construction Group (CCCG) was ranked No. 9, and achieved higher total revenue comparison with the No. 10 construction firm, Technip, but CCCG's international revenue only accounted for approximately 24.29% of total revenue, Technip' international revenue account around 98.74% of its total revenue. Additionally, CCCG possessed the lowest international revenue of the top 10 international contractors. CCFs should be required to pay attention to their financial capability in international business to compete with other countries' construction enterprises.

Section 4.2 illustrated that the global construction market grew rapidly in each section and region. Especially, the infrastructure sector in the developing regions, such as the Middle East, Africa, and Asia. Some factors changed with the rapid development of global construction market, for example, tender conditions, financial resources and the level of competition. The development and changing issues in the global construction market required construction firms to improve their competitiveness to respond to the turbulent market. However, CCFs should be required to understand the unique characteristics of China's construction industry transformation and development, in order to seek a balance between CCFs' international competitiveness and global construction market developments.

4.3 China’s construction industry

China's construction industry has moved from a centrally planned economy to a socialist market economy and has been moving towards an integration with the world community. This transformation has been based on China's unique charateristicas: huge population, traditional culture, government dominance long term strategic planning and short history of market competition. All these have been identified as particular characteristics in China’s construction industry (Lu 2006).

4.3.1 Overview of China’s economic development

China possessed the largest population country in the world and the third largest in land area with a population of 1.36 billion people and a land area of 9.6 million square kilometres (CSYB 2014). China’s economy has been taking off since 1978 when it adopted the “open-door” policy and launched economic reforms as a platform for modernization; since then, China has moved from a centrally controlled economy to a socialist market economy (Lu 2006). Over the past thirty years, China’s economic transformation has been very impressive. Table 4.6 demonstrated the growth rate of selective industries and total GDP at five yearly intervals between 1978 and 2013.

Table 4. 6: Every five years of China’s GDP from 1978 to 2013 (Billion Yuan)

	1978	**1983**	**1988**	**1993**	**1998**	**2003**	**2008**	**2013**
GDP	365.0	597.6	1510.1	3552.4	8488.4	13656.5	31675.2	58801.9
Growth rate		38.92%	64.43%	57.49%	58.15%	37.84%	56.89%	46.13%
Primary industry	101.8	196.1	383.1	688.7	1461.8	1696.8	3274.7	5532.2
Secondary industry	173.6	263.3	655.4	1637.3	3880.9	6212.1	14809.8	25681.0
Tertiary industry	89.6	138.2	471.6	1226.4	3145.7	5747.6	13590.7	27588.7
Per captial GDP (Yuan/person)	382	584	1371	3015	6835	10600	23912	43320

Source: Author’s compilation from the China Statistical Yearbook (2014).

The average five yearly growth rate of GDP has been 44.98% since 1978 and the amount of GDP achieved a new height of RMB¥58801.9 billion by 2013 (CSYB 2014). The structure of China’s economy has been transformed owing to intensifying economic reforms (Table 4.7). The transformation of the China's economic structure can also be seen from the fact that China has found it necessary to develop and integrate diversified forms of ownership (Lu 2006).

Table 4. 7: Comparison of GDP in terms of different industries every five years from 1978 to 2013 (Billion Yuan)

	1978	1983	1988	1993	1998	2003	2008	2013
Agriculture	102.7	197.8	386.6	696.3	1481.6	1737.9	3369.3	5696.6
Manufacturing	160.3	237.0	576.3	1415.2	3393.2	5480.6	12992.9	21726.4
Construction	13.8	27.1	81.0	226.7	498.6	749.1	1874.3	4080.7
Retail	24.2	19.9	148.3	281.7	691.3	1117.0	2618.2	5628.4
Transport	18.2	27.5	68.6	217.4	466.1	791.3	1636.3	2603.6
Accommodation and catering	4.5	7.3	24.0	71.2	178.7	312.6	661.6	1022.8
Finance	7.7	16.9	65.9	190.3	431.4	603.5	1831.3	4119.1
Real estate	8.0	12.2	47.4	138.0	343.5	617.3	1473.9	3598.8
Others	25.6	52.0	112.1	315.8	1004.1	2247.4	5217.4	10325.5

Source: Author's compilation from the China Statistical Yearbook (2014).

Table 4.7 has revealed that the share of agriculture in GDP had declined and the share of tertiary activity has increased over the last thirty years. While shares of manufacturing, construction, transport, and real estate in terms of GDP have increased.

While China's economy has made significant progress, some problems have arisen.

Regional differences

Because of the concentration of economic development in the eastern coastline regions of China, significant imbalances of development and wealth gaps between the east and the other regions have been extensive. In order to bridge this gap, the Chinese government practised two strategies. One was the western region's development started in 2006 (National Development and Reform Commission (NDRC) 2006). The main composition of the western region's development included the development of infrastructure, enticement of foreign investment, increased efforts concerning ecological protection, promotion of education, and retention of talent flowing to richer provinces (Chun-Chien 2010). The other involved strategy for Revitalizing the Old Industrial Bases of the Northeast proposed in 2009 (State Council of China (SCC) 2009). The core of this strategy was to revitalize China's northeast region's traditional industry, while speeding up development concerning aspects of structural regulations, regional cooperation, economic reforms, the construction of an environmental-friendly economy, and increased efforts in education, healthcare, and cultural projects (SCC 2009). As a result, the central government

invested a large amount of infrastructure in these regions in order to stimulate these regions' economic development (Kuang *et al*. 2016).

Extensive Income Gaps and Problems between China's Agriculture, Rural Areas, and Farmers

The notable imbalance of China's economic development could also be seen in the inequality income between urban residents and farmers. Rural people have benefited from the economic reforms, improving food consumption and basic living conditions. However, at the same time, there was also a trend towards widened income disparities between urban and rural people. For example, in 2013, the per capita disposable income of urban residents was RMB ¥26,955.1 Yuan, but for rural residents was RMB ¥8,895.9 Yuan; Engel's coefficient was 35 per cent and 37.7 per cent respectively for urban and rural areas (CSYB 2014). Moreover, rural development between eastern regions and western regions has shown an imbalance with disparities in income and growth, especially between industrial-based coastal regions and agricultural-based inner areas (Quan and Liu 2002). In 2013, the per capita disposable income of eastern regions was RMB ¥32,472 Yuan, but in western regions it was RMB ¥22,710 Yuan (CSYB 2014). The increasing gap has created social tension and some discontent. The government has recognized that problems concerning China's agriculture, rural areas and farmers needed to be addressed as a priority. Therefore, the government has introduced measures such as lowering or cancelling taxation on agriculture in order to solve the income plight of the farmers (Lu 2006).

Overheating of the economy in relation to fixed assets

One of the serious problems has been overheating and excessive investment in the real estate industry. A range of policy measures has not succeeded in stabilizing this. This has caused a limited supply of energy and resources, such as power, coal, and land. Central government then preferred to pursue a "continuous, rapid and healthy development of the national economy" (Yang 2002). A series of macro-control policies and measures, including a prudent fiscal policy, and administrative intervention has been adopted to cool down the overheating real estate economy (Liu *et al.* 2003).

Modest performance in sustainable development

It has been recognised that the rapid development over recent years has not been a sustainable utilisation of resources. On the contrary, the economy has been developed at low cost and environmental deterioration (Lu 2006). Related to this, China's government advocated the implementation of the "Scientific View of Development", which incorporated a principle that emphasized the value of human beings, by integrating economic development and social development, and promoting the harmonisation between human beings and nature (Hu 2007).

Despite the above initiatives, China faced some significant challenges with respect to economic development, it achieved momentous growth (Table 4.8) in national savings, DGP growth and improvement of human capital. Factors contributing to such achievements were an abundance of low-cost labour supply and its large domestic market plus a massive influx of Foreign Direct Investment (FDI) since 1980 (CSYB 2009-2014; Li 2017).

Table 4. 8: China's economic development indicators

	1978	1988	1993	1998	2003	2008	2013
National saving (Billion Yuan)	21.16	380.15	1476.23	5340.7	10361.75	21788.54	107058.80
Human capital (Billion Yuan)	/	4553.1	6184.5	7623.7	13610.9	19661.4	30711.2
Cost of labour supply (Yuan/Per)	615	1747	3371	7446	13963	28898	51489
Foreign Direct Investment (Billion dollar)	/	5.30	111.44	52.10	115.07	/	117.59

Source: Author's compilation from the China Statistical Yearbook (2009-2014) and report of China's human capital (Li 2017).

China's economic development provided an opportunity for CCFs to expand their business in the domestic market, because China promoted construction as a pillar industry to stimulate the development of the national economy. This allowed more and more CCFs to be established in China, when fierce competition was increasing in the domestic market. The next section has analysed how China has developed its construction industry, in order to understand the background with respect to reasons why CCFs were required to improve their international competitiveness.

4.3.2 Overview of China's construction industry

There have been a number of studies that have analysed features of the construction industry. Some researchers have analysed the construction industry in general. For example, Hillebrandt (1974) applied economic theory the construction industry and provided a construction economic framework for analysing the construction industry by market, firm, cost, price, demand, and supply. Otherwise the focus was on a particular industry, such as China's construction industry. For example, Flanagan and Li (1997) examined the characteristics of the Chinese construction industry from three aspects: history and transition of the whole economy, demand for infrastructure, and housing, and business operations. Chen (1998) stated the characteristics and status of China's construction industry included output, in relation to the economy as a whole, enterprises and labour forces, and demand. Shen and Chan (2003) considered three phases of the construction business environment, including the general environment, regulative framework,

and business relationships. Lu (2006) highlighted seven areas that guided an investigation in to the characteristics of China's construction industry, including government bodies, the legal system, qualification management, competitive mechanisms, pricing management, quality monitoring and management, and entry into WTO.

In this section, China's construction industry has been mainly investigated from four aspects: the historical developmental issues, government institutions, licenses and qualification management and the project quality monitoring.

4.3.2.1 The historical development of China's construction industry

China's construction industry differed from other countries' construction industries from two aspects. One aspect was that the China's construction industry was characterized by an extreme level of government control (Lu 2006), because it moved from a planned economy to a socialist market economy, a strong governmental supervision over the majority of construction companies was required, the majority of work were commissioned and funded by the public sector (Walker *et al.* 1998); the other aspect was that it was one of the five seminal industries in the national economy, the role of the construction industry has been vital to the socio-economic development of the country (Bajaj and Zhang 2003). Walker *et al.* (1998) suggested that governmental influence in the construction market in China would continue within the framework of a socialist market economy, although such an influence was changing from a traditional administrative control to legal monitoring.

Before the "open-door"policy, the construction industry in China was controlled by the government and has been supported China's centrally planned economy (Mayo and Liu 1995; Bajaj and Zhang 2003). Most construction projects were financed by government, designed by state-owned design institutes, and built by state-owned construction companies (Lu 2006). Two factors have driven the Chinese gorvenment's involvement in the construction industry: one was project funding, that was supported mainly by the government in the form of capital construction; the other was resource allocation by the government. State-owned design institutions and construction enterprises were assigned by workload, and building materials and equipment were supplied by the government according to its economic plans. In addition, the profit rate for state owned enterprises and the price of construction products were heavily regulated by the gorvenment (Bajaj and Zhang 2003).

The open door policy was the watershed of China's construction industry's development (Pan 2011). Especailly since 1992, China's construction industry took off as the economy grew (Lu 2006). Construction industry reforms were announced at a similar time as open-door policy at the 14th National Congress of Communist Party of China in October 1992, which was the most

important political event in China. The Congress strongly restated the direction of China's reform policies. Most significantly, the party gave its stamp of approval to a free market economy as the stimulus for China's future prosperity (Jiang 1992). These reforms were designed to improve efficiency in state-owned construction firms, to establish an openingin the construction market, and to make Chinese construction firms more competitive in the international market (Mayo and Liu 1995). Thus, many changes have reshaped the blueprint of the Chinese construction industry. First, the change relating to centralized state finance from traditionally governmental-free allocations to a combination of bank loans, self-raised funds by companies, and finance through international joint ventures; Second, investment decisions have been delegated from the central government to local governments, state-owned companies, and collective companies. Third, the introduction of an open tendering system has induced government link institutes and construction enterprises to tender for projects rather than be allocated projects by the government. Fourth, the Chinese construction industry is changing rapidly from traditionally state-owned firms' domination to business-shared among various types of organisations including collectively-owned firms, private firms, and foreign joint ventures (Bajaj and Zhang 2003; Shen *et al.* 2004).

In 1996, the Chinese government nominated construction as a "pillar industry" for contributing to the rapid and sustainable development of the national economy. The construction industry was expected to respond to the huge demands for infrastructure and housing in China that underpinned economic growth. Furthermore, The government viewed infrastructure and housing investment as one of the regulators to stimulate the national economy, which would result in a large number of national fixed asset investments, and would then turn China in to one of the world's largest construction markets in the world (Lu 2006). In line with continuing demand for housing and infrastructure construction, China's construction industry has been continuing to maintain rapid growth over recent years. Consequently, China's construction industry has grown rapidly and has become one of the largest in the world (EUSME centre 2015).

Since China formally became a member of the World Trade Organisation (WTO) in December 2001, the market environment and competition has changed the base of China's construction industry; the operation of the Chinese construction industry was going to be further reformed towards competitive procurement practices (Shen *et al.* 2004) (Table 4.9). China's construction industry would share the benefits, and would assume responsibilities according to the General Agreement on Tariffs and Trade (Garcia 2014). Indigenous construction companies would no longer enjoy special protection from the government, and would compete with international enterprises on an equal basis. The implementation of the WTO framework would increase the legal enforcement in the construction industry. A comprehensive understanding, combined with a

rapid response to the changes brought about by the WTO was critical for Chinese construction firms to improve their competitiveness (Lu 2006).

Table 4. 9: Indicators of China's construction industry in selected years 1980-2014 (billion Yuan)

	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014
Construction GDP	19.55	41.79	85.94	372.88	552.23	1036.73	2717.76	3284.00	3680.48	4080.73	4478.96
Construction gross output value	28.69	67.51	134.50	579.37	1249.76	3455.21	9603.11	11705.97	13721.79	15931.30	17671.34
Value added of construction	N/A	N/A	N/A	166.86	334.11	689.97	1898.35	2207.10	2658.33	3076.85	3527.02
Total profits	N/A	N/A	N/A	7.42	19.21	90.67	340.91	416.82	477.61	N/A	640.71
Total tax	N/A	N/A	N/A	24.22	38.72	115.98	335.13	386.44	438.89	N/A	554.71

Source: Author's compilation from the China Statistical Yearbook (1996-2015)

Table 4.9 showed that the indicators related to China's construction industry from 1980 to 2014 have been revealed over selected years. Construction GDP, construction output value, the valued-added of construction activities have been hugely increased since the open door policy was introduced and the WTO joined.

China's construction industry comprised almost 81,141 construction enterprises in 2014, including state-owned, collectively-owned, those funded by Hong Kong, Macau, Taiwan and foreign investment, Joint owned and shareholding enterprises. Table 4.10 has indicated the number of construction firms in China. An interesting trend was that the number of state-owned and collectively-owned firms, and funding by Hong Kong, Macau and Taiwan have decreased after 2000. WTO has made the Chinese market more attractive, more and more international construction firms were expected to participate in the Chinese construction industry after China joined in WTO (Lu 2006). There were 388 foreign construction firms which had contracts in China in 2005; however, these firms have decreased from 2005 to 2014. However, the joint-owned, private, and shareholding construction firms increased after 2000. It can be seen that the WTO, to some extent, has opened up opportunities in the Chinese construction market. Thus, many people could establish private companies to engage in construction businesses. Additionally, the WTO brought vigorous competition into the market, consequently, domestic construction firms have been required to change their ownership from state-owned, and collectively-owned

enterprises to joint owned, and share holding enterprises, in order to adjust to competition in the market.

The construction industry has attracted millions of people, as revealed in Table 4.10. There were numerous enterprises, and large workforces involved in the construction industry, in which the sector has made a substantial contribution to the national economy and employment. Table 4.10 has indicated the steady growth of labour productivity in terms of gross output value and value added after 1995. However, Flanagan and Li (1997) and Lu (2006) considered that intense competition would undermine the health of the industry in the long-term, moreover, most labourers have come from rural areas and lacked professional training, even though China possessed a large number of professionals, such as, designers and engineers. The imbalance between professionals, and labourers exacerbated problems, such as poor construction quality, a low safety record, and insufficient protection of workers' rights. Still, with the introduction of market competition, improved technology, and innovation, productivity in the construction industry has increased.

Table 4. 10: The number of construction firms, manpower and labour productivity 1980-2014 in selected years

	Number of construction firms (Unit)						Number of persons employed (10000 persons)					Overall labour productivity in terms of Gross output value (Yuan/person)					Overall labour productivity in terms of value added (Yuan/person)
	Total	State-owned	Collective-owned	Funded by Hongkong Macau and Taiwan	Funded by foreign	Others (Joint owned, private and share holding	Total	State-owned	Collective-owned	Funded by Hongkong Macau and Taiwan	Funded by foreign	total	State-owned	Collective-owned	Funded by Hongkong Macau and Taiwan	Funded by foreign investment	Total
1980	6604	1996	4608				648.0										
1985	11150	3385	7765				911.5										
1990	13327	4275	9052				1010.7										
1995	24133	7531	15348	329	312	613	1497.87	824.31	631.89	4.96	5.41	38680	44525	30060	67768	61379	11140
2000	47518	9030	22905	635	319	12778	1994.30	635.55	823.23	8.22	4.40	59585	73301	44142	93447	100620	15925
2005	58750	6007	8090	516	388	43749	2699.92	480.05	361.57	8.65	10.82	117317	154436	75922	161706	169063	23427
2010	71863	4810	5026	416	331	61280	4160.44	576.87	246.53	12.16	9.80	203962	271857	138580	192698	304913	40319
2011	72280	4642	4847	393	303	62095	3852.47	444.94	220.40	11.31	9.87	233104	339049	158153	437310	43799	43951
2012	75280	4602	4640	385	295	65358	4267.24	457.78	216.24	12.97	10.28	296424	388406	222006	449499	378776	57427
2013	79528	4607	4572	389	280	70682	4499.31	477.48	222.97	15.39	11.19	324842	439212	246679	433498	455640	62737
2014	81141	3753	3589	369	261	73169	4536.97	371.15	175.03	15.44	8.63	317633	413401	234669	292054	538592	63396

Source: Author's compilation from the China Statistical Yearbook (1999-2015)

The competitive environment of China's construction market has been changing with its accession to the WTO. It has meant that Chinese construction firms faced greater challenges in the new competitive market. It has also meant that CCFs have been required to develop their competitive advantage by competing with international competitors. It was essential for CCFs to fully understand the new market environment, by improving their advantage and by eliminating their weaknesses.

4.3.2.2 The evolution of government institutions in China's construction industry

In order to understand the competitiveness landscape in China' construction industry, it was thought important to conduct an investigation in to government institutions' evolution. Luo and Gale (2000) noted that China's construction industry had undergone five evolutionary stages over the past forty years, see Table 4.11 below:

Table 4. 11: The historical transformation of the construction authorities in China

Periods	Events
1) 1950-1952 Recovery period of the national economy	08/1952: Ministry of building engineering (MOBE) was established
2) 1953-1958 First five-year plan	11/1954: State construction commission was established 04/1956: Ministry of urban construction (MOUC) was established
3) 1958-1965: second Five-year plan and three-year economic adjustment	02/1958: State construction commission was cancelled. MOBE, MOUC and Ministry of Building Material Industry (MOBMI) were merged into a new institution—Ministry of Building Engineering (MOBE). 10/1958: State construction commission was reinstated again. 01/1961: State construction commission was thirdly removed. 03/1965: State Capital Construction Commission (SCCC) was set up and MOBE was divided into MOBMI and MOBE again
4) 1966-1976 Ten years of cultural revolution	07/1970: SCCC, MOBE and MOBMI were merged and replaced by a new political institution—the Revolutionary Commission of Capital Construction
5) New era of reform since 1978	12/1978: The CCP launched reform. 05/1982: Previous construction authorities were cancelled. Ministry of Urban and Rural Construction and Environmental Protection (MURCEP) was established. 04/1988: MURCEP was removed and preparations were made to reorganize ministry of construction (MOC). 07/1988: MOC was formally set up. 03/2008: MOC changed to Ministry of Housing and Urban-Rural Development (MOHURD)

Source: Author adapted from Luo and Gale (2000)

It can be seen that China's construction policies were uncertain and unstable during the period of pre-reform from 1949 to 1978, because the Chinese leadership lacked experience in management and administration during that period (Luo and Gale 2000). Until recently, the government played an important role in all aspects of the construction industry. It had been able to affect the industry, not only as a government in its function of managing the economy, and development, and was responsible for maintaining standards, but also directly as a client (Zhu and Dong 1997). Four ministries managed China's construction industry, which were the Ministry of Housing and Urban-Rural Development (MOHURD), National Development and Reform Commission (NDRC), Ministry of Land and Resources (MLR), and Ministry of Commerce (MOFCOM). The MOHURD has played a leading role in implementing strategies for developing the construction industry in China. It has implemented national policies and has administered construction activities through local Construction Commissions, which had administrative control over design institutes, construction enterprises, building research organisations, and other related activities to the construction industry. Additonally, it had the comprehensive responsibility for drafting policies, laws and development plans related to urban planning, construction, and urban infrastructure development (MOHURD 2017). The NDRC was a ministerial committee with the power to control and standardize China's macroeconomics profile and future planning, it assumed the primary responsibility for sustainable development and implementation of the government's agenda. For example, it proposed the capital investment of fixed assets, made funding plans for national construction projects, and managed major foreign currency investment projects (NDRC 2017). The primary responsibilities of MLR were for planning, administration, protection and the rational utilization of natural resources, such as, land, minerals, and marine resources in China. One of its most important responsibilities relating to the construction industry was to compile and implement national comprehensive planning for land use, which was one of the most crucial features for the construction industry (MLR 2007). The responsibilities of MOFCOM were for overseas contract business, giving approval for Chinese construction firms to work globally and taking a general administrative role for these enterprises. In addition, foreign enterprises were mainly subject to joint supervisions of the MOFCOM and the MOC when engaging in the construction business in China (MOFCOM 2010).

4.3.2.3 Licences and qualification management

The qualification management in the Chinese construction industry was the management of Qualification for Enterprises (QoE) (MOHURD 2014), and the Qualifications for Professionals (QoP) (MOHURD 2017b). The first one was a distinguishing feature of China's construction industry, the second one's major purpose was to reinforce the supervision of the construction market, and project quality (Lu 2006).

Qualification for Enterprises (QoE)

The QoE was a "one qualification certificate, one business licence" system, which required a firm to obtain a certificate first, then acquire a licence for undertaking projects. QoE in China has been mainly defined in two official documents: the Construction Law (NPC 2011), and Regulations on Administration of Qualification of Construction Enterprises (MOHURD 2015). Some key points about the *QoE* have been listed below (Shen *et al.* 2004; MOHURD 2015):

(1) The MOHURD was responsible for general administration of QoE
(2) Contractors were divided into three types: main contractor, specialist contractor, and labour sub-contractor
(3) The criteria for assessing QoE levels included registered capital, annual construction output, technical capacity and previous performance
(4) Four grades have been categorised in this series of enterprises: Special Grade (highest level), Grades I, II, and III. The grade can be lowered or upgraded based on an official annual review. Enterprises were not allow to lend or sell their QoE documentation
(5) A company could only undertake projects which fell within its qualified grade
(6) Main contractors might undertake the whole of a construction project or the major part of a construction project by itself, or subcontract the non-major part of the project or labour service to specialized contractors or labour sub-contractors
(7) Specialist contractors might subcontract the specialized project by main contractors or undertake the specialized project by investors and owners. A specialist contractor might construct the whole project by itself, or subcontract the labour service to a labour sub-contractor
(8) A labour sub-contractor might subcontract a labour service by a main contractor, or specialist contractor

The purpose of *QoE* management was to strengthen supervision of construction activities to maintain functionality in the construction market, and to ensure the quality of construction projects (Shen and Chan 2003).

Qualifications for Professionals (QoP)

In China, construction Law has stipulated that professional and technical personnel should engage in construction activities, and should obtain corresponding qualifications of professionals, and to engage in construction activities within the context permitted by the qualification of the professional body (NPC 2011). Since the middle of the 1990s, several professions have been established in the Chinese construction industry in order to develop a professional system, and to improve the standard of professionals' performance (Shen *et al*. 2004). The implementation of QoP in China has significantly contributed to construction's industrial transformation, market demands and project quality. The main QoPs in China's construction industry included:

(1) Registered Project Supervision Engineers

(2) Registered Constructors

(3) Registered Structural Engineers

(4) Registered Project Cost Engineers

(5) Registered Survey and Design Engineers

(6) Registered Real Estate Valuers

(7) Registered Urban Planners

However, Flanagan and Li (1997) stated that the administration of QoP in China was different from international practices. First, China's government took responsibility for administering QoP. MOHURD dominated all the registering and monitoring of individual professions; Chinese government's education department approved all training courses. Secondly, to secure relationship issues between construction enterprises and professionals have been established. Professionals had to registered after obtaining qualification certificates, so that they could use the "signature and stamp" in their companies as qualified professionals. However, they were not allowed to register themselves in different enterprises at the same time. In addition, there existed a weak relationship between professionals and associations. It was also different from Western countries where professionals were allowed to found their career communities in associations, such as, the Chartered Institute of Building (CIOB) and American Society of Civil Engineers (ASCE). Moreover, the number of professionals was critical in obtaining corresponding *QoE's* grades. Construction companies were required to enrol enough professionals who held certificates of QoPs in order to qualify a company for a higher grade in *QoE* (Lu 2006).

Although QoE and QoP were implemented in the Chinese construction industry to control and manage construction firms' project operations, the project quality still remained poor, and performance and required strong monitoring.

4.3.2.4 Project quality monitoring

One of the serious problems in China's construction industry was poor quality. China could produce good quality, but this concept was not deeply rooted in the construction industry, or in labour quality (Flanagan and Li 1997). Chen (1998) stated that the reasons for poor quality of construction ranged from design, materials, weak management, ambition to achieve goals and lack of workers' skills. Flanagan and Li (1997) considered that the extra impacts of old quality control practices and lack of well-qualified project managers, resulted in the poor quality of projects. Therefore, one of the major challenges of China's construction industry was to improve

construction quality. The Chinese government has issued various laws and regulations, such as Construction Law (NPC 2011) and a Regulation on Construction Project Quality Management (SCC 2000), in order to improve construction quality when considering the importance of construction projects with respect to public safety and property. Major points of these regulations were included in the documents (SCC 2000 and NPC 2011):

(1) All project parties including clients, surveyors, designers, contractors, and project supervision units had quality responsibilities
(2) Construction contracts only granted to qualified contractors
(3) Government departments required to supervise the quality of construction
(4) Construction quality must satisfy the benchmarks set by the government
(5) The quality performance grading system will be used to assess contractors' performance, and quality grade could affect a firm's business qualification grade
(6) The completion of a project with the client's satisfaction will be confirmed by a "PASS" certificate which will be recorded in a government office.
Other processes have been carried out in order to improve construction quality. Such as a LuBan Prize, a national construction quality award to encourage construction firms to complete projects to at an excellent standard (CCIA 2017). The number of prizes for quality was one of the key factors in determining a firm's qualification grade. Severe punishments would be faced if any quality problems were associated with the project, including reducing the qualification grade, suspension of tendering, and penalties (SCC 2000).

Quality Management has been encouraged in the construction industry. At present, China's construction industry has adopted quality standards, such as ISO9000, in order to meet international requirements. In addition, various regulations of project quality have been published by the Chinese government, such as the Code of Construction Project Management (GB/T50319-2013), in which project quality is assessed to correspond with national standards, to improve supervision engineers and project managers' quality management ability, and a project's material should be standardised, as should contract management and equipment (MOHURD 2013).

Section 4.3 illustrated three main aspects of China's construction industry. First, it was transformed from a non-profit-making sector to a profit-making sector in the national economy. Secondly, in line with the open door policy and accession into WTO, CCFs faced competition with international companies in the construction market. Thirdly, China transformed its government institutions in order to effectively promote the construction industry's development, and relevant policies and regulations were formulated to monitor the activities in construction. All of these aspects required CCFs adapt to a market economy and improve competitiveness in commercial

enterprises. In the next section, CCFs' development issues in both domestic and global markets have been analysed.

4.4 Chinese construction firms

In this section, the characteristics of the Chinese construction Firms (CCFs) have been investigated. It is deemed necessary to understand how CCFs competed in the market if an attempt is made to assess and improve their competitiveness. In this section, the features of CCFs have been investigated from three aspects: CCFs' historical development, key players in the CCFs and their operations in the global construction market.

4.4.1 The historical development of Chinese construction firms

The historical developments of CCFs can be separated into three stages: Pre-1970s, 1970s—1990s and Post-2000s (Low and Jiang 2003).

- Pre-1970s: firms worked on a non-profit basis on agreed projects to satisfy target plans.

In the 1950s, in order to achieve the objective of ''liberation and independence of brotherhood countries in the third world,'' the Chinese government was able to secure agreements with developing countries, and, consequently, to send its state-owned contractors to complete non-profit construction projects, based on agreements between the Chinese government and the host governments (Low and Jiang 2003). These contractors turned over all revenue to the state and their only objective was to satisfy the target plan (Ma 1993; Wang *et al*. 2006).

Achievements

In this period, the international participation of CCFs was mainly for financial aid projects in some developing countries with funds provided by the Chinese government (Table 4.12).

Table 4. 12: Chinese government's economic and technical aid pre-1970s

Source: Lan (2011)

Problems

While China made remarkable improvement under this system, its construction technology and management still lagged behind developed countries (Chen 1998). Essentially, these financial aid

projects did not constitute part of the international construction market for the following reasons: 1) these were not driven by market incentives or profit-driven for the enterprises; 2) all project costs and other spending were funded by the Chinese government; and 3) firms, which were involved in the projects were not participating in any decision-making activities (Lan 2011). However, the CCFs involved in the financial aid projects gained basic concepts about the global market, and many personnel who played an important role when China opened its door to the world were encouraging to train (Low and Jiang, 2003).

- 1970s – 1990s: the reform of companies' structures and ownership were established to meet the demands of international construction markets.

Before the economic reforms in 1978, all construction enterprises were owned by the state and its agencies. The enterprises had little autonomy to choose projects, which were assigned by the government and attained through administrative means (Chen 1998).

With the introduction of the open door policy, CCFs became increasingly active in the market. During this period the Chinese government assigned bilateral projects to contractors and supported all finances for construction work (Huang *et al.* 2013). There were three major types of construction firms in the domestic market: state-owned enterprises (SOEs), urban and rural collectives (URCs) and rural construction teams (RCTs) (Chen 1998). However, SOEs were under an assignment system controlled by the government, while URCS and RCTs were market oriented, and had a more flexible management, but poor quality and low professional and management levels (Chen 1998; Huang *et al*. 2013). In the international market, the Ministry of Foreign Economic Relations and Trade (MOFERT) was responsible for any overseas contracting business, giving approval for contractors to undertake overseas projects (Chen 1998). On August 13, 1979, the State Council of China introduced an Act which allowed Chinese specialized companies to undertake projects overseas (Low and Jiang 2003). Thus, Large-scale SOEs were able to obtain licences to bid projects in the global market as "commercial entities". These particular licences for CCFs undertaking projects abroad were issued by the MOFERT, mainly to SOEs. Therefore, these firms were China's pilots into global construction markets (Zhao and Shen 2008).

Subsequently, many CCFs, changed their corporate structure and ownership in order to meet demands for the global market. These firms reformed gradually from initial state-owned status to commercial entities (Low and Jiang 2013). This change has been a great success in improving construction productivity (Wang *et al.* 2006). These enterprises participated in international bidding, undertaking commercial projects, and negotiating with their foreign counterparts; their motivation became profit-driven (Lan 2011). Since the early 1990s, some of the largest SOEs had gained experience in the global market. Then, at provincial-level, and in some other regional companies it was possible to obtain licences for international contracting. By 1994, several of the

more established CCFs were established. Thereafter, the profitable CCFs were encouraged to be listed on the stock market following a strict evaluation exercise, which meant they would no longer be protected by the government. Between 1997 and 1998, many SOEs were completely separated from their respective government organisations. Large scale SOEs were supervised by the newly established Office of Large Scale State-Owned Enterprises under the State Council (Low and Jiang 2003). Most international management structures of CCFs included a local agent, representative office or liaison office, subsidiaries, and joint venture and branch (Lan 2011).

Achievements

After the open-door policy was published in 1978, the Chinese construction industry has rapidly developed to become the third major sector of the national economy (Chan and Chan 2002) and many CCFs have also been participating in the global construction market. Most international projects were in infrastructure in developing countries (Low and Jiang, 2003). These projects contributed to the economic development of the host countries through the completion of highways, dams, hydroelectric power stations, transmission lines, and buildings; during this period, Chinese international contracted services included residential, petrochemical, transportation, manufacturing, water supply and drainage, water conservancy and electric power, which covered almost all fields in the international construction market (Lan 2011).

Problems

In line with the promotion by the Chinese government, the number of the CCFs entering into international markets was growing rapidly (Low *et al.* 2004). However, the Chinese construction industry was still not yet mature enough, and had been criticized for poor quality, schedule delay, and cost overruns (Walker 1991). In the global market, the price-war among CCFs in some developing countries had begun with their international expansion (Low and Jiang 2003). For example, in Africa, very few local construction firms were able to undertake large scale projects or had the competence to compete with CCFs. Thus, the competition was often between the CCFs themselves. As a result, a "low bidding price" was growing among CCFs (Zhao and Shen 2010). The impact of a "low bidding price" on CCFs in the overseas market was considerable, and resulted in a substantial reduction in profits (Lan 2011).

- Post-2000s: emergence in global construction markets

After the 1990's, large Chinese firms expanded their operations overseas. In order to support those Chinese contractors undertaking foreign construction projects, in 2000, the SCC documented the launch of a fund containing a special interest rate backed by the Ministry of Finance, and was available from state-owned banks (SCC 2000). One of China's commitments was to open up the construction market after it was formally admitted into the WTO in 2001 (Xu *et al*.

2005). In this period, more than 1,600 Chinese companies had the required qualifications to carry out international projects and construction contracts, but the dominant ones were large state-owned enterprises, such as, China State Construction Engineering Corp. (Lan 2011). The types of international projects were mainly concentrated in building construction, communications, transportation, the petrochemical industry, and the power industry (Li *et al*. 2001). In 2014, China established the Asian Infrastructure Investment Bank to provide capital for infrastructure in developing countries. The consequent effects of these measures were significant in boosting international business.

Achievements

Many CCFs, considered entering international construction markets as a major strategy (Li 2006; Zhao and Shen 2008). International expansion might be viewed as a strategy to promote competitiveness because CCFs could learn advanced management skills and technologies from their overseas competitors (Zhu 2006). The construction projects undertaken by CCFs in the international market usually fell into six categories (Zhao and Shen 2008):

(1) Projects activated by the World Bank, the Asia Development Bank, and the Africa Development Bank
(2) Investment by host governments
(3) Projects financed by Chinese export credit to developing countries
(4) Aid projects initiated the Chinese government
(5) Projects invested in by Chinese enterprises
(6) The Chinese embassy or consulate buildings in foreign countries

In line with the development of the integration of global economies, and China's accession to the World Trade Organisation (WTO), governmental efforts have brought significant progress in obtaining overseas projects for CCFs (Wen 2005; Hu 2007; Zhao and Shen 2008). One main driver behind the Chinese government's support was to strengthen and develop global competitiveness by transferring the emphasis from cost advantages in low and medium-tech industries to differential advantages in hi-tech industries (Jansson and Soderman 2013). Many Chinese contractors have started to strategically develop their overseas construction markets (Zhao and Shen 2008). An interesting example of this was the sale of one of Australia's leading infrastructure firms, John Holland, to a state-owned Chinese construction giant, China Communications Construction Company, giving the Chinese firm access to new markets in Australia and overseas (Quirke 2015).

Problems

The CCFs would face increasing competition in the domestic market, as the Chinese construction market was becoming rapidly internationalised in line with the WTO agreement, which allowed foreign companies to set up wholly owned enterprises in China five years after China's entry to the WTO (Low and Jiang 2003). Despite the CCFs decision to undertake overseas projects in more than 180 countries, they were still largely concentrated in their traditional markets of Asia and Africa (Tong 2003).

Financing ability was one of the key factors for successful bidding for competitive international projects. Most global construction companies were capable of financing a project (Lan 2011). In a changing environment, CCFs have been required to rationalise their management structure by casting off useless assets, optimising the use of capital, and adopting advanced management techniques (Cui 2004).

Moreover, technological innovation played an essential role in the construction industry's development. There existed a considerable technological gap between companies in China, and developed countries. It was significant that the CCFs paid attention to technological innovation and applied advanced technologies, in order to transform the labour-intensive business model to the intelligence-intensive model (Cheng 2010).

The historical development of the Chinese construction industry has shown that CCFs have experiences to positively grow in the global construction market. However, they also have problems related to their competitiveness when they were expanding international business, such as poor quality, schedule delays and cost overruns.

4.4.2 Key players in China's construction market

Engineering News Records (ENR) first aggregated the international revenue from CCFs in its annual ranking of the "*Top 225 International Contractors*" in the 1996 issue (reflecting 1995 revenue). It was the first time that large CCFs began assisting the ENR in encouraging Chinese construction enterprises to participate (Tulacz and Reina 2007). Since then, CCFs appeared in the ENR's *"Top International Contractors*" ranking list for many years.

Key CCFs might be identified from the ENR's annual ranking of "*Top International Contactors*", which is ranked by construction firms' international revenue. Table 4.13 has listed the 27 Chinese construction enterprises which were ranked in the Top 100 International Contractors by ENR from 2004 to 2014, and a comparison of their ranking positions in the "Top Chinese contractors" in 2014, which was ranked by the CCFs' contracting revenue has been revealed. Table 4.14 has revealed the Top 10 CCFs in 2013 and 2014.

It can be seen that the key CCFs in the global construction market were all state-owned enterprises (Table 4.13), because the Chinese government supported state-owned construction enterprises to enter overseas markets with bilateral trade agreements. Also, state-owned construction firms were the key players in the domestic market. In the "Top 10 Chinese contractors" (Table 4.14), only the Guangsha Construction Group Co. Ltd. and Zhongtian Construction Ltd. were private enterprises.

In addition, the Top CCFs' international revenue accounted for only a small proportion of total revenue. For instance, China Communications Construction Group achieved most international revenue when compared with the other top Chinese contractors, but this company obtained the lowest international revenue of the top 10 international contractors (Table 4.5). Table 4.14 ranked CCFs by the Chinese contractors' contracting revenue. The Shaanxi Construction Engineering Group Corporation, the Shanghai Urban Construction Group and the Guangsha Construction Group Co. Ltd. respectively achieved $8,400.90 million, $8,363.27 million and $8,142.34 million ranking them No. 5, No.6 and No. 7 of the Top 10 Chinese contractors in 2014. However, they could not be included in the top 250 of international contractors, which were ranked by firms' annual international revenue. The China State Construction Engineering Corporation Ltd. was the top Chinese contractor, achieving $97,870.17 million in 2013, but its international revenue account amounted to only 5.87% of its contracting revenue. The international revenue of the China National Machinery Industry Corp, SEPCOIII Electric Power Construction Corp, China Civil Engineering Construction Corp., China International Water & Electric Corporation, and CGC Overseas Construction Group Co. Ltd, all contributed to over 90% of the total revenue, because the goal of establishing these companies was for undertaking overseas projects, their main market was out-side China, however, their international revenue was still less than other international construction companies, such as Grupo ACS, Bechtel, and HOCHTIEF AG.

This has revealed that Chinese contractors' main markets were in China and in aid-projects in Africa, where substantial profits could not be achieved owing to bilateral agreements between the Chinese and African governments. As a result, Chinese construction firms needed to consider their international competitiveness. Sustainable development only based on the government's aid- projects would not be sufficient to generate significant overseas profits.

Table 4. 13: List of key CCFs in the global construction market over last decade

Company name	type	Ranking in top 250 International contractors in 2014											Contracting revenue ($MIL) in 2013	International revenue ($ MIL) in 2013	International revenue accounted %
		2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004			
China Communication Construction Group Ltd	State-owned	9	10	10	11	13	17	18	14	45			54,181.7	13,162.5	24.29%
China State Construction Engineering Corp.	State-owned	20	24	22	20	22	25	21	18	20	17	17	97,870.2	5,742.7	5.87%
SINOHYDRO Group Ltd.	State-owned	23	20	23	24	41	56	50	51	68	81	81	20,674.7	5,314.4	25.70%
China National Machinery Industry Corp	State-owned	25	25	24	26	26	28	48	55	50			5,789.8	5,288.9	91.35%
China Railway Group Ltd.	State-owned	28	34	39	33	53	62	71	67	67	48	48	88,944.0	4,766.9	5.36%
China Railway Construction Corp Ltd.	State-owned	39	53	30	29	25	51		83	73			96,195.0	3,486.0	3.62%
CITIC Construction Co. Ltd.	State-owned	46	43	46	32	32	59	72	98				3,156.6	2,830.9	89.68%
China GEZHOUBA Group Co. Ltd.	State-owned	51	56	62	71	84	99						8,921.7	2,532.7	28.39%
SEPCOIII Electric Power Construction Corp	State-owned, subsidiary of Power Construction Corporation of China	58	54	53	58	79	95					99	2,587.4	2,356.3	91.07%
China Petroleum Pipeline	State-owned, subsidiary of the China National Petroleum	63	98		89	76							4,032.0	2,114.0	52.43%

Bureau	Corporation														
Shanghai Electric Group Co. Ltd.	State-owned	64	72	67	78	78	83						2,998.3	2,105.5	70.22%
China Metallurgical Group Corp	State-owned	68	51	42	61	31	61	81	95	93		98	27,256.3	1,945.0	7.14%
China Civil Engineering Construction Corp.	State-owned	71	71	91	86	86	72	100	82	76	69	63	1,968.5	1,879.5	95.48%
China Petroleum Engineering & Construction Corp.	State-owned Public	76	84	48	27	46	100	76	70	60	58	54	3,004.3	1,576.6	52.48%
Dongfang Electric Corp.	State-owned	79	92	83	80	80	80	86				74	7,302.5	1,480.4	20.27%
China National Chemical Engineering Group	State-owned	82	82	77	92		90	97	88	94			10,119.2	1,315.5	13.00%
China International Water & Electric Corporation	State-owned	84	86	92					97	97		97	1,294.0	1,266.2	97.85%
China General Technology (Group) Holding Ltd.	State-owned	85	81	89									4,693.1	1,123.6	23.94%
SINOPEC Engineering (Group) Co. Ltd.	State-owned Public subsidiary of the Sinopec Group	89	91		83	69	94						7,146.6	1,153.2	16.14%
CGC Overseas Construction	State-owned	93	89	93									1,068.0	1,057.5	99.02%

Group Co. Ltd.															
Qingjian Group Co. Ltd.	State-owned	98	95										7,359.0	945.0	12.84%
SEPCO ELECTRIC POWER CONSTRUCTION CORP	State-owned, subsidiary of Power Construction Corporation of China	102	61	64	100	101							2,033.7	900.8	44.24%
Shanghai Construction Group	State-owned	129	96	86	54	89	103	90	73	64	68	50	24,820.1	550.7	2.219%
SINOPEC ZHONGYUAN PETROLEUM ENGINEERING LTD	State-owned	137		99	118			94	90				1,972.3	528.9	26.82%
China Harbour Engineering	State-owned, subsidiary of China Communication Construction Group Ltd										39	36			
Harbin Power Engineering	State-owned			97	95	108									
China Road & Bridge Corp.	State-owned, subsidiary of China Communications Construction Company										84	71			

Source: Author's compilation from the top 250 international contractors (ENR 2004-2014)

Table 4. 14: Top 10 Chinese construction firms from 2013 to 2014

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Source: The top 80 Chinese contractors and the top 250 international contractors (ENR 2013-2014)

4.4.3 Chinese construction firms in the global market

The CCFs' performance has been analysed in this section, according to their market size, contractual value, turnover regions and segments. In section 4.4.1, CCFs' development was divided into three periods: pre-1907s, 1970-1990s and post 2000s; additionally, two milestones of the CCFs' development were identified: the open-door policies in 1978 and the accession into the WTO in 2001. Owing to the unavailability of comprehensive and continuous data from 1950 to 1978, hence, only two periods: from 1979 to 2001 and from 2002 to 2014 were selected for data analysis.

4.4.3.1 CCFs in the global construction market during the periods from 1979 to 2001

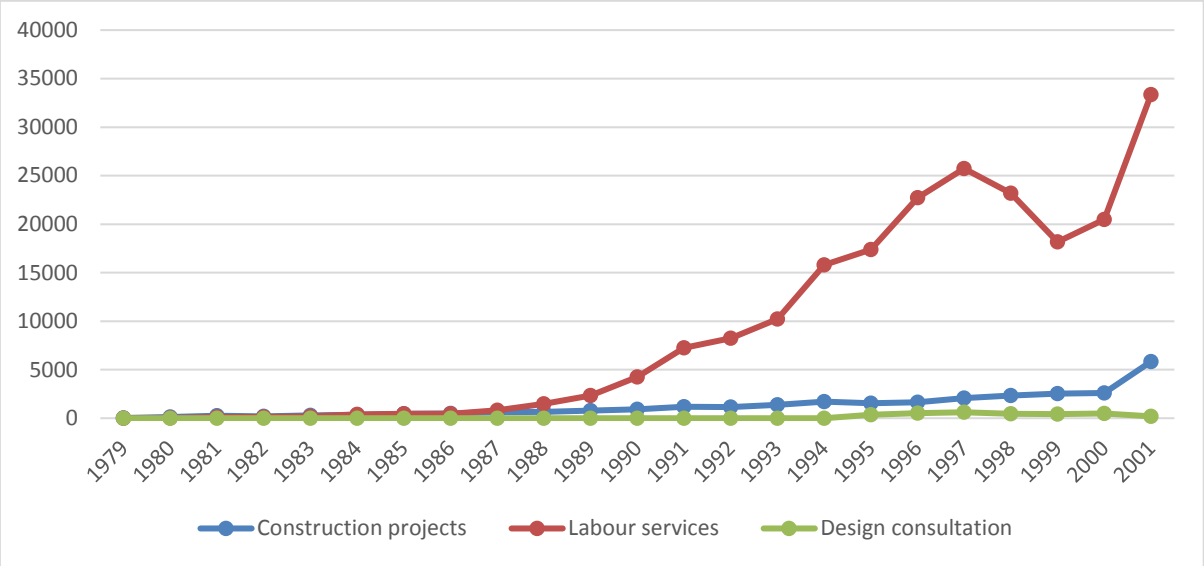
Table 4.15, 4.16, 4.17, and 4.18, have respectively indicated that the number of contracts the CCFs signed with other countries, concerning contractual value, turnover fulfilled and turnover in different regions from 1979-2001. These contracts included three areas: construction projects, labour services and design consultation. The data on the design consultation were only displayed from 1995 to 2001 owing to data unavailability.

Table 4. 15: CCFs' number of contracts from 1979 to 2001

Year	Number of countries or regions with contracts signed	Number of contracts (unit)			Total
		Construction projects	Labour services	Design consultation	
1979	11	27	N/A	N/A	27
1980	16	138	34	N/A	172
1981	36	250	113	N/A	363
1982	38	195	119	N/A	314
1983	40	280	180	N/A	460
1984	52	344	396	N/A	740
1985	71	465	458	N/A	923
1986	83	486	458	N/A	944
1987	95	616	833	N/A	1449
1988	103	642	1484	N/A	2126
1989	124	776	2324	N/A	3100
1990	122	920	4255	N/A	5175
1991	147	1171	7267	N/A	8438
1992	159	1164	8241	N/A	9405
1993	158	1393	10212	N/A	11605
1994	171	1702	15789	N/A	17491
1995	178	1558	17397	366	19321
1996	178	1634	22723	534	24891
1997	181	2085	25743	614	28442
1998	188	2322	23191	442	25955
1999	187	2527	18173	426	21126
2000	181	2597	20474	494	23565
2001	N/A	5836	33358	206	39400

Source: Author adapted from China Statistical Year Book (2014) and Lan (2011)

Figure 4. 4: CCFs' number of signed contracts from 1979 to 2001



Source: Author's compilation from China Statistical Year Book (2014)

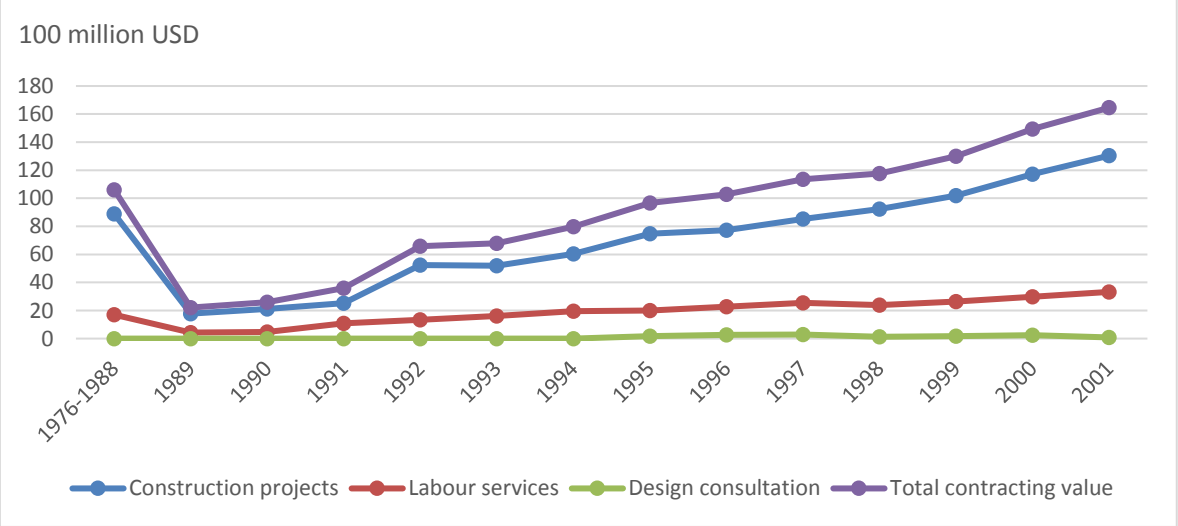
Table 4.15 illustrated that CCFs carried out international projects in only 11 countries or regions with a total of signed contracts numbering 27 in 1979. Following the open door policy in 1978, CCFs gradually undertook international projects in more countries, reaching the highest amount numbering 188 countries with 25,955 signed contracts by 1998. It decreased after 1998 but the total number of signed contracts rose to 39,400 for the year 2001. Figure 4.4 has revealed that between the years of 1984 to 1987, the number of construction projects and labour services were about equal. However, CCFs' labour services increased with a sharp rise after 1988.

Table 4. 16: CCFs' contractual value from 1976 to 2001

Year	Contractual value by type (100 million USD)			
	Construction projects	Labour services	Design consultation	Total contractual value
1976-1988	89.00	16.95	N/A	105.95
1989	17.81	4.31	N/A	22.12
1990	21.25	4.78	N/A	26.04
1991	25.24	10.85	N/A	36.09
1992	52.51	13.35	N/A	65.85
1993	51.89	16.11	N/A	68.00
1994	60.28	19.60	N/A	79.88
1995	74.84	20.07	1.81	96.72
1996	77.28	22.80	2.65	102.73
1997	85.16	25.50	2.90	113.56
1998	92.43	23.90	1.40	117.73
1999	101.99	26.32	1.71	130.02
2000	117.19	29.91	2.33	149.43
2001	130.39	33.28	0.88	164.55

Source: Author adapted from China Statistical Year Book (2002)

Figure 4. 5: CCFs' contractual value from 1976 to 2001



Source: Author's compilation from China Statistical Year Book (2002)

Table 4.16 showed that since the implementation of the open-door policy, the overall trend of total contractual value had increased. The contractual value increased rapidly from the total contractual value $2212 million dollars in 1989 to $16455 million dollars in 2001, which was about seven times the value from 1989 to 2001. Comparisons between Figure 4.4 and 4.5 has shown that CCFs' main type of contract was connected to labour services, which increased faster after 1988 than construction projects and design consultations, however, the contractual value of

construction projects were much higher than labour services after 1988. Additionally, total contractual value has risen sharply with respect to construction projects' contractual value, demonstrating that the CCFs' contractual value was mainly produced from construction projects, rather than labour services and design consultations.

As shown in table 4.17, the total value of turnover fulfilled by CCFs during 1976-1988 was $6091 million dollars.

Table 4. 17: CCFs' turnover fulfilled from 1976 to 2001

Year	turnover fulfilled by type (100 million USD)			
	Construction projects	Labour services	Design consultation	Total
1976-1988	49.70	11.21	N/A	60.91
1989	14.84	2.02	N/A	16.86
1990	16.44	2.23	N/A	18.67
1991	19.70	3.93	N/A	23.63
1992	24.03	6.46	N/A	30.49
1993	36.68	8.70	N/A	45.38
1994	48.83	10.95	N/A	59.78
1995	51.08	13.47	1.33	65.88
1996	58.21	17.12	1.64	76.96
1997	60.36	21.65	1.82	83.83
1998	77.69	22.76	0.89	101.34
1999	85.22	26.23	0.90	112.35
2000	83.79	28.13	1.34	113.25
2001	88.99	31.77	0.63	121.39

Source: Author adapted from China Statistical Year Book (2002)

Table 4.17 displayed that turnover fulfilled reached $12,139 million dollars in 2001. Turnover produced from construction projects accounted for a large proportion of the total turnover achieved. The turnover from design consultation was less than $200 million dollars from 1995 to 2001. This revealed that CCFs paid more attention to achieving turnover by undertaking projects.

Table 4.18 demonstrated that from 1998 to 2001, the CCFs' turnover in different regions was categorised based on the types of contracts. Over half of the turnover generated by CCFs was achieved in the Asian market each year, while Africa was the second largest market of international contracts fulfilled by CCFs.

Table 4. 18: CCFs' turnover in different regions from 1998 to 2001

Region (Million dollars)		Asia	Africa	Europe	Latin America	North America	Oceanic & Pacific islands	Other	Inner country	Total	Contract types Per cent in total
1998	Construction project	5322.31	1870.64	238.80	103.76	111.07	99.69	36.25	1460.64	9243.16	78.51%
	Labour services	1547.64	144.14	246.23	48.37	203.90	47.90	15.58	135.84	2389.60	20.30%
	Design consultation	30.21	4.34	4.20	0.9	6.81	2.04	N/A	91.97	140.47	1.19%
	Total	6900.16	2019.12	489.23	153.03	321.78	149.63	51.83	1688.45	11773.23	100%
	Region Per cent in total	58.6%	17.2%	4.2%	1.3%	2.7%	1.3%	0.4%	14.3%	100%	
1999	Construction project	4502.09	1827.70	125.93	71.84	103.67	119.50	44.14	1727.45	8522.32	75.86%
	Labour services	1711.00	203.12	171.02	69.69	225.34	62.50	14.29	165.72	2622.68	23.34%
	Design consultation	34.10	5.47	9.21	2.13	1.87	0.21	0.08	36.51	89.58	0.80%
	Total	6247.19	2036.29	306.16	143.66	330.88	182.21	58.51	1929.68	11234.58	100%
	Per cent in total	55.6%	18.1%	2.7%	1.3%	2.9%	1.6%	0.5%	17.2%	100%	
2000	Construction project	4794.77	1096.21	354.46	168.20	129.14	123.22	38.17	1674.80	8378.97	73.98%
	Labour services	1912.27	185.14	183.98	62.93	233.12	42.53	34.32	158.27	2812.56	24.83%
	Design consultation	29.60	5.86	3.95	1.03	1.95	0.41	N/A	91.03	133.83	1.18%
	Total	6736.64	1287.21	542.39	232.16	364.21	166.16	72.49	1924.10	11325.36	100%
	Per cent in total	59.5%	11.4%	4.8%	2.0%	3.2%	1.5%	0.6%	17.0%	100%	
2001	Construction project	4662.88	1524.06	563.67	262.84	245.42	104.87	39.90	1495.93	8899.57	73.31%
	Labour services	2188.06	222.25	201.59	63.79	166.76	32.44	2.56	299.46	3176.91	26.17%
	Design consultation	44.43	6.17	1.62	0.49	2.43	0.54	1.19	5.96	62.83	0.52%
	Total	6895.37	1752.48	766.88	327.12	414.61	137.85	43.65	1801.35	12139.31	100%
	Per cent in total	56.8%	14.4%	6.3%	2.7%	3.4%	1.1%	0.4%	14.8%	100%	

Source: Author adapted from China Statistical Year Book (1999-2002)

As presented in Table 4.18, the total turnover from operating in the Asian market was over $6 billion dollars between 1998 and 2001. Constituting the largest proportion, construction projects

accounted for over 75% of the turnover on average. The remaining proportion was almost entirely occupied by labour services with the average number amounting to approximately 23% per year. However, the the proportion of design consultations turnover never exceeded over 2% of total turnover.

By the end of 2001, CCFs were active in more than 180 countries or regions. The total number of international projects during this period included construction projects, labour services and design consultation was about 245,432. The contractual value reached $16.46 billion dollars and turnover fulfilled reached $12.14 billion dollars in 2001. Athough the labour services for signed contracts accounted for a huge proportion of the total signed contracts, the turnover was mainly produced from construction projects. According to the regional distribution of Chinese overseas contracting business, Asia was the largest market and Africa was the second largest market for CCFs. Besides the Asian and African markets, the CCFs' international contracting business in other markets was relatively small at less than 11% of total turnover on average from 1998 to 2001.

4.4.3.2 CCFs in the global construction market during the periods from 2002 to 2014

The potential of global projects by Chinese construction firms was expected to rise after accession to the WTO. According to WTO's market access and national treatment principles, construction markets in corresponding countries should reciprocate by lowering their entry barriers, and be open to CCFs, as they enjoyed similar treatment in China (Garcia 2014).

The number of contracts, contractual value and turnover obtained by CCFs' construction projects were analysed from 2002 to 2014. However, the data related to labour services and design consultation were not available for this period.

Table 4. 19: CCFs' number of contracts from 2002 to 2014

Year	Construction projects		
	Number of contracts (unit)	Contractual value (100 million USD)	Turnover fulfilled (100 million USD)
2002	4036	150.55	111.94
2003	3708	176.67	138.37
2004	6694	238.44	174.68
2005	9502	296.14	217.63
2006	12996	660.05	2299.93
2007	6282	776.21	406.43
2008	5411	1045.62	566.12
2009	7280	1262.10	777.06
2010	9544	1343.67	921.70
2011	6381	1423.32	1034.24
2012	6710	1565.29	1165.97
2013	11578	1716.29	1371.43
2014	7740	1917.56	1424.11

Source: Author adapted from China Statistical Year Book (2015)

Table 4.19 showed the number of contracts kept on increasing during this period. In 2006, it reached 12,996 at its peak. The contractual value was increasing during the entire period. It started from $15.01 billion dollars in 2002 and increased by 12 times to $191.76 billions dollars in 2014. The turnover fulfilled reached $229.99 billion dollars in 2006, however, it declined for two consecutive years, and then kept on increasing until 2014. Although the number of contracts in 2014 revealed a slight drop when compared with 2013, however, the contractual value reached $191.76 billion dollars and turnover fulfilled achieved $142.41 billion dollars, both higher than in 2013.

In this period, CCFs have undertaken construction projects worldwide. Table 4.20 has presented the distribution of CCFs' annual turnover fulfilled in different regions.

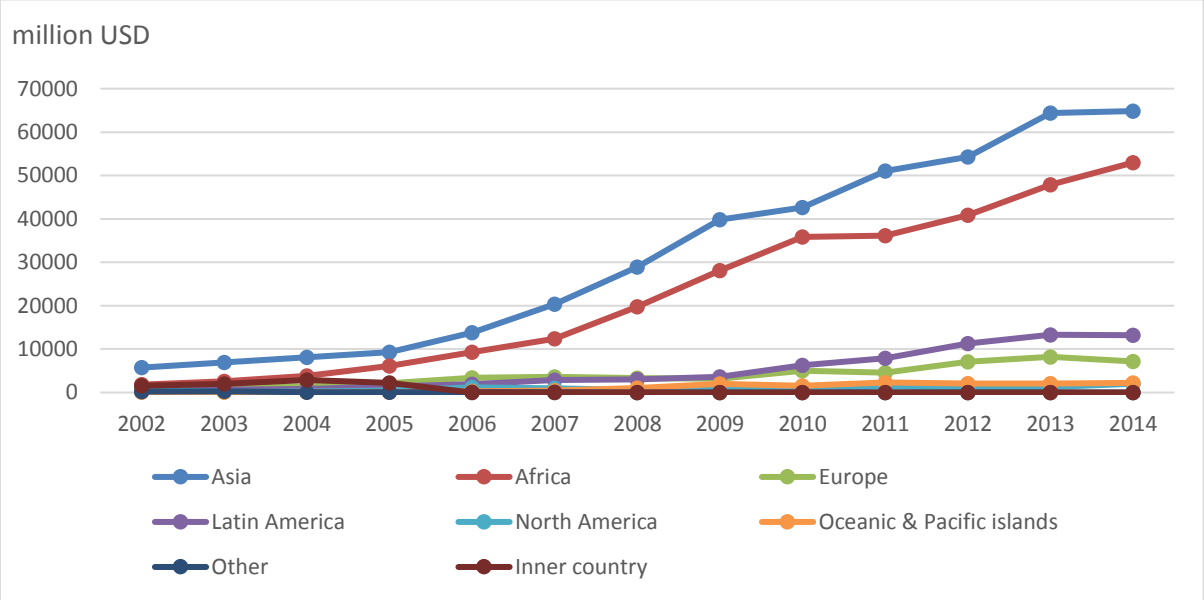
Table 4. 20: CCFs' turnover fulfilled by construction project in different regions from 2002 to 2014.

Region (million USD)		Asia	Africa	Europe	Latin America	North America	Oceanic & Pacific islands	Other	Inner country	Total
2002	Turnover fulfilled	5737.91	1813.57	909.31	347.22	573.04	91.16	190.25	1531.12	11193.58
	Per cent in total	51.26%	16.20%	0.89%	3.10%	5.12%	0.81%	1.70%	13.68%	100%
2003	Turnover fulfilled	6926.64	2601.25	1160.53	648.00	161.05	55.64	273.09	2011.16	13837.36
	Per cent in total	50.06%	18.80%	8.39%	4.68%	1.16%	0.40%	1.71%	14.54%	100%
2004	Turnover fulfilled	8141.58	3813.10	1393.67	807.89	248.72	94.74	80.55	2888.04	17468.29
	Per cent in total	46.61%	21.83%	7.98%	4.62%	1.42%	0.54%	0.46%	16.53%	100%
2005	Turnover fulfilled	9317.88	6092.22	2132.81	1413.09	432.46	70.35	88.95	2215.48	21763.24
	Per cent in total	42.81%	27.99%	9.80%	6.49%	1.99%	0.32%	0.41%	10.18%	100%
2006	Turnover fulfilled	13771.73	9324.06	3423.37	1912.96	1208.56	306.81	45.32	N/A	29992.81
	Per cent in total	45.92%	31.09%	11.41%	6.38%	4.03%	1.02%	0.15%	N/A	100%
2007	Turnover fulfilled	20352.95	12376.08	3585.96	2877.86	985.26	418.38	46.09	N/A	40642.58
	Per cent in total	50.08%	30.45%	8.82%	7.08%	2.42%	1.03%	0.11%	N/A	100%
2008	Turnover fulfilled	28902.66	19749.05	3299.32	2995.47	588.25	1068.30	8.63	N/A	56611.68
	Per cent in total	51.05%	34.89%	5.83%	5.29%	1.04%	1.89%	0.02%	N/A	100%
2009	Turnover fulfilled	39811.17	28098.99	3174.64	3644.18	935.95	2005.78	35.40	N/A	77706.11
	Per cent in total	51.23%	36.16	4.09%	4.69%	1.20%	2.58%	0.05%	N/A	100%
2010	Turnover fulfilled	42658.11	35830.27	4987.23	6274.49	888.32	1530.39	1.44	N/A	92170.25
	Per cent in total	46.28%	38.87%	5.41%	6.81%	0.96%	1.66%	0.002%	N/A	100%
2011	Turnover fulfilled	51021.72	36121.87	4600.42	7916.69	1422.32	2322.65	18.81	N/A	103424.48
	Per cent in total	49.33%	34.93%	4.45%	7.65%	1.38%	2.25%	0.02%	N/A	100%
2012	Turnover fulfilled	54292.81	40834.52	7061.82	11316.31	1006.94	2069.00	15.57	N/A	116596.97

	Per cent in total	46.56%	35.02%	6.06%	9.71%	0.86%	1.77%	0.001%	N/A	100%
2013	Turnover fulfilled	64397.58	47890.64	8227.37	13309.42	1259.19	2049.27	9.26	N/A	137142.73
	Per cent in total	46.96%	34.92%	6.00%	9.70%	0.92%	1.49%	0.006%	N/A	100%
2014	Turnover fulfilled	64838.18	52974.75	7150.57	13180.59	2017.36	2247.61	1.60	N/A	142410.66
	Per cent in total	45.53%	37.20%	5.02%	9.26%	1.42%	1.58%	0.001%	N/A	100%

Source: Author adapted from China Statistical Year Book (2003-2015)

Figure 4. 6: Represented CCFs' turnover fulfilled by construction project in different regions from 2002 to 2014.



Source: Author's compilation from China Statistical Year Book (2003-2015)

As presented in Table 4.20, total turnover fulfilled by CCFs' construction projects steadily increased 12 times from $11.19 billion dollars in 2002 to $ 142.41 biillion dollars in 2014. Figure 4.6 showed that CCFs' main construction markets were in Asia and Africa, because the Chinese government had provided financial aid for implementing projects in some developing countries (Low and Jiang 2003). Annual turnover value increased significantly after 2009 in European and Latin American regions, although their turnover was less than in Asia and Africa. It was considered that CCFs had further opportunities to explore construction markets in Europe and Latin America. The above statistical data illustrated the CCFs' focus on the Asian and African construction markets, because the Chinese government has enjoyed long-standing friendly

relations with these countries. However, at present, CCFs needed to pay close attention to Europe and Latin America, as the WTO facilitated their entry into these regions in order to explore more business opportunities.

In addition, the ENR's statistical data have been employed to identify these key CCFs' segments in the global construction market. Table 4.21 indicated the business segments of key CCFs that were ranked in the Top 100 international contractors over the last decades.

Table 4. 21: CCFs' segments in the global construction market

Company name	Segments								
	General building	manufacturing	power	Water supply	Sewer/waste	Industry/petroleum	transportation	Hazardous waste	telecom
China Communication Construction Group Ltd	√		√	√	√	√	√		
China State Construction Engineering Corp.	√		√	√	√		√		
SINOHYDRO Group Ltd.	√		√	√	√		√		
China National Machinery Industry Corp	√		√	√		√	√		√
China Railway Group Ltd.	√	√	√	√	√	√	√		
China Railway Construction Corp Ltd.	√	√	√				√		
CITIC Construction Co. Ltd.	√					√	√		
China GEZHOUBA Group Co. Ltd.	√		√	√	√	√	√		
SEPCOIII Electric Power Construction Corp.			√						
China Petroleum Pipeline Bureau						√			√
Shanghai Electric Group Co. Ltd.			√						
China Metallurgical Group Corp	√		√	√		√	√		
China Civil Engineering Construction Corp.	√			√			√		
China Petroleum Engineering & Construction Corp.						√			
Dongfang Electric Corp.			√				√		
China National Chemical Engineering Group	√		√			√			
China International Water & Electric Corporation	√		√	√			√		
China General Technology (Group) Holding Ltd.			√	√		√	√		
SINOPEC Engineering (Group) Co. Ltd.						√			
CGC Overseas Construction Group Co. Ltd.	√		√	√			√		
Qingjian Group Co. Ltd.	√			√			√		
SEPCO ELECTRIC POWER CONSTRUCTION CORP			√						
Shanghai Construction Group	√		√				√		
SINOPEC ZHONGYUAN Petroleum Engineering Ltd.						√			
China Harbour Engineering	√	√		√	√		√		
Harbin Power Engineering			√						
China Road & Bridge Corp.				√		√	√		
Total	16	3	18	14	6	13	18	0	2

Source: Author adapted from ENR (2004-2014)

Table 4.21 revealed that key CCFs were focused on power, transporation and general building. However, not one company in these top CCFs engaged in the hazardous waste business. Some CCFs have undertaken single segments, for example, SEPCOIII Electric Power Construction Corp. and Harbin Power Engineering only engaged in power segments, China Petroleum Engineering & Construction Corp. only engaged in the petroleum business. Nevertheless, other companies were involved in comprehensive areas, for instance, China Railway Group Ltd. carried out projects in general building, manufacturing, power, water supply, sewer or waste, petroleum, and transportation.

4.4.3.3 SWOT analysis of the CCFs in the global construction market.

This section reviewed the relevant literature in order to understand the general factors affecting CCFs' strengths, weaknesses, opportunities, and threats.

Strengths

- Manpower: low costs, good skills and a high degree of adaptability when working in different environments (S1)

During the period from 2003 to 2013 the overall labour productivity of Chinese construction firms in international markets increased by 1.1times (CSYB 2004–2014). Low *et al*. (2004) and Zhao and Shen (2008) indicated that Chinese workers usually attended intensive training programmes before being sent to overseas construction sites; most Chinese workers were multi-skilled and would be involved in each stage of construction. Additionally, Chinese managers, engineers, and labourers often lived on-site in very simple accommodation; thereby, improving effective understanding and communication, and reducing costs (Corkin 2007).

- Price: lower component costs (S2)

It has been suggested by Low *et al.* (2004) that the relatively low cost of construction machinery, materials and equipment from China promoted the reduction of the bidding price for Chinese firms. This is echoed by Corkin (2007) who maintained that the cost per square metre of construction for CCFs was one-quarter of that of Europeans companies. Therefore, the practice of awarding construction contracts to the lowest bidder in the global market has given an advantage to Chinese firms.

- Technology: advances and resultant productivity (S3)

Chinese construction firms have been making progress in improving productivity by using advanced technologies. According to Hu (2005), Chinese construction enterprises employed world-class advanced construction technologies in certain areas, including highways, and railroad bridges, tunnels, and underground passes, super high-rise buildings, large structure, and equipment hoisting, pre-stressed concrete, and the pouring of mass concrete. Low *et al.* (2004)

and Shang *et al*. (2006) pointed out that CCFs enjoyed major technical advantages in a number of areas, and were capable of undertaking increasingly technically complex projects in the global construction market.

- Relationships: good relations with developing countries (S4)

Many developing countries, particularly in Africa and the Middle East, had long-standing, established friendly relationships with China. Bilateral construction business activities in these developing countries had been greatly promoted by governments (Low *et al.* 2004). These good business connections encouraged CCFs in building strong relationships with local governments, clients, and local people. Consequently, CCFs had accumulated experience in operating business in an international context.

Weaknesses

- Human Resources: a lack of well-trained human capital (W1)

Zhao and Shen (2008) indicated that low salaries and poor working conditions made the construction industry unattractive to well-educated people. Yan (2005) and Zhu (2006) pointed out that CCFs generally lacked trained professionals, particularly, in the areas of: project management, contract administration, risk management, finance management, and international conventions and laws. The lack of well-trained human capital in CCFs has been considered one of the most serious weaknesses contributing to poor business performance.

- Design Capability: Absence of design capability (W2)

Jin and Zhang (2006) indicated that design and construction work were traditionally separated in China and undertaken by two different types of firms: design institutes and contractors. Zhu (2006) commented that very few CCFs had the ability to undertake both design and construction work. In China, contractual projects for the comprehensive renewal of urban Central Business Districts had been awarded to foreign design companies. For example, the UK-headquarters architect BDP was designing the CBDs for Wuhan (GCR 2015). Zhao and Shen (2008) indicated that many clients in international markets preferred to award the main contract to a contractor who could collectively undertake the consultancy, design service and construction work. This practice has been highlighted as a weakness in CCFs and has put them at a disadvantage when bidding for large projects in the international market.

Opportunities

- Government encouragement and promotion, corresponded with China's accession to the WTO (O1);

China's joining the WTO in 2001; offered new opportunities to CCFs to operate their businesses in the global market. In order to integrate its economy with global economies, the Chinese government began encouraging its enterprises to enter overseas markets. The government considered exporting services equally as important as attracting foreign investment to China (Zhao and Shen 2008). According to a policy paper, issued by President Hu Jintao, and Premier Wen Jiabao (Wen 2005; Hu 2007), it illustrated that by entering the international market was one of the major governmental policies for further implementing national economic reforms. Corresponding with this, the Chinese government began helping CCFs to compete for projects in overseas markets by developing and enhancing bilateral and multilateral cooperation with foreign countries, improving the efficiency of administration in approving overseas construction works, and reducing CCFs' customs duties.

- Financial support by state-owned banks (O2)

The Chinese State Council published a document in 2000 requiring the Ministry of Finance and state-owned banks to adopt measures to help CCFs (Zhao and Shen 2008). CCFs could apply for loans from state-owned banks and were able to enjoy special interest rates when undertaking projects in overseas construction markets (Zhao and Shen 2008).

- Asian Infrastructure Investment Bank (AIIB) initiated by China (O3)

The AIIB was established by China's President Xi Jinping and Premier Li Keqiang in 2013, with founding members from 57 countries. The AIIB aimed to provide support capital for infrastructure in developing countries (AIIB 2015). This supported those CCFs exploring wider markets and undertaking international projects.

Threats

- High business risk (T1)

According to Zhao and Shen (2008), two major reasons contributed to CCFs' risk:

1) Developing countries, in general, lacked funds, and project clients in these countries often had a poor knowledge of contractual conditions. Therefore, there was a higher possibility that CCFs would face client defaults in payment.

2) CCFs have had to hire local labourers and purchase some local construction components. However, any unexpectedly high inflation in these countries could greatly increase project costs. This has been considered a major factor in affecting and lowering CCFs' profits.

- High political risks (T2)

Political risks were high in developing countries. Typically, the policies concerning the appointment of CCFs could change dramatically as a result of a change or replacement of

government leaders. This was echoed by Zhao and Shen (2008), who suggested that many CCFs had experienced losing substantial amounts of business because of changes of governments or officials.

According to the existing literature, the typical attributes for examining CCFs' a SWOT analysis has been identified, see Figure 4.7.

Figure 4. 7: SWOT analysis of CCFs' international competitiveness

	Helpful	Harmful
Internal	***Strengths*** • *Human resource capabilities* • *Lower bidding price* • *Advanced technology* • *Good relationship with developing countries*	***Weaknesses*** • *Lack of professional project managers* • *Absence of design capability*
External	***Opportunities*** • *Government encouragement and promotion* • *Financial support by state-owned banks Asian Infrastructure Investment Bank initiated by China*	***Threats*** • *High business risk* • *High political risks*

Source: Author (2015)

Section 4.4 revealed that CCFs were transformed from non-profit organisations to commercial enterprises and achieved positive growth in global construction market. State-owned firms were the key players in the domestic market, because they had strong support from the Chinese government. The SWOT analysis showed that CCFs had a competitive advantage in the global market, but some weakness and threats affected the CCFs' international operation. Therefore, CCFs were required to identify the drivers of competitiveness, in order to assess and improve their international competitiveness.

4.5 Key Competitiveness Indicators (KCIs) of construction firms

KCIs assisted an enterprise when defined and measured by its competitive progress towards corporate goals. Currently, academics and practitioners have struggled with a set of common KCIs used by construction firms. As section 3.4 analysed, many researchers identified the important indicators contributing to construction firms' competitiveness, such as, financial statements (Gerstel 1991), safety (Arslan and Kivrak 2008), training and education (Bednarz 1997), organisational structure (Shen *et al* 2003), quality (Belohlav 1993), and tender prices (Marzouk *et al.* 2013).

Within these studies, a range of indicators had been identified. However, the set of KCIs was still one of most comprehensive frameworks for assessment. Because KCIs were one of the main factors in measuring firms' competitiveness and could assist construction firms in assessing its competitiveness to improve performance.

As stated by the Engineering News Record's (ENR), annual ranking of the top 250 international construction firms, a total of 182 global construction firms have been ranked in the Top 100 over the past 10 years by their international revenue (see appendix IV), with 155 international contractors, and 27 Chinese contractors being identified. In order to understand these construction companies' annual reports more easily, 60 international companies were operating in the UK (see appendix V) and the 27 Chinese construction firms (see appendix VI), have been selected as samples. With respect to the aim of this research, the 48 secondary literature reviews relevant to competitiveness theory (Table 4.22) and the annual reports of 60 of Britain's top construction firms (Table 4.23) and 27 Chinese construction firms (Table 4.24) have been selected in order to identify the construction firms' KCIs. NVivo 11 software was applied to code the KCIs in the secondary literature.

Table 4. 22: Identifying key competitiveness indicators in the secondary literature review

Reference / Key Competitiveness Indicators	1 Buckley, P. J *et al* (1988)	2 Williams, J. R. (1992),	3 Belohiav, J. A. (1993).	4 Chaharbaghi, R. F. K. (1994)	5 WALKER, D. H. T. (1995)	6 Greenan, K. *et al* (1997)	7 FONG, P. S.& CHOI, S. K. (2000)	8 Alarcó´n, L. F *et al. (2002)*	9 Porter, M. E. (2004)	10 Ambastha, A. *et al* (2004)	11 CHENG, E. W. L. *et al* (2004).	12 Chew, D A S and Liu, G (2004)	13 Ngowi, A.B *et al* (2005)	14 Wang, X. *et al.* (2006)	15 WANG, D. *et al* (2006)	16 Singh, D. *et al* (2006)	17 Flanagan, R. *et al.* (2007)	18 Zhao & Shen (2008)	19 Sha,K (2008)	20 Stuart,D. e *t al.* (2008)	21 DOLOI, H(2009)	22 Polat, G. (2009)	23 LI, H. *Et al.* (2009)	24 CHEN, C. *et al* (2009)	25 Smit (2010)	26 Pires, A. J. G. (2010)	27 Blois, M. *et al(2011)*	28 Huang, X. (2011)	29 Marín,L. (2012)	30 Langston, C. (2012)	31 Cristóbal, J. R. S. (2012)	32 Poveda-Bautista, R *et al*	33 Vaz, E. C. (2012).	34 Huang, Y. *et al.* (2013)	35 FORSMAN, H. *et al* (2013)	36 Alzahrani, J. I. (2013)	37 Gao, Y. *et al(2013)*	38 Stojcic, N. *et al* (2013)	39 Jin *et al.,* (2013)	40 JAFARI. A (2013)	41 Zilke, J. and Taylor, J. (2014).	42 Jesús C. *et al* (2014)	43 Garell. S. (2014).	44 Mitkus, S.(2014)	45 Dälken, F. (2014)	46 Yu, H. *et al, (2014)*	47 Spigarelli, *et al.* (2015)	48 Huang, K. *et al (2015)*	Number of time cited
Value-added for stakeholders	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x		x	x	x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x	42
High productivity	x	x	x		x					x		x					x	x	x	x	x	x	x		x	x					x	x		x	x	x	x	x			x						25
Quality	x	x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	42
Construction safety and environmental safeguards	x	x		x	x	x		x	x	x		x	x		x	x		x	x	x	x		x	x				x			x			x	x	x	x		x	x	x	x		x	x	x	31
Social resposibility	x	x		x	x	x											x		x	x			x	x			x		x	x					x	x	x	x						x		x	21
Reputation		x	x	x			x			x					x	x		x	x			x	x					x	x	x		x				x	x						x	x		21
Corporate culture	x	x			x													x	x						x								x										x				11
Corporate experience							x	x			x		x		x		x	x			x		x						x	x	x		x				x		x	x	x		x			x		19
Employee management	x				x								x					x		x		x								x					x				x								12
Risk management					x	x	x	x	x		x					x	x	x		x	x		x					x	x	x		x				x	x	x	x	x	x	x				25
Communication and corporation			x		x	x		x		x			x			x		x				x		x			x	x	x	x		x			x		x	x	x	x		x	x	x	25
Technology management	x	x	x	x					x	x		x			x								x	x		x			x			x	x		x		x						x	x	20
Information technology					x				x	x							x		x								x		x														x	x	12
R&D		x		x		x			x	x		x			x							x	x	x		x	x			x			x			x	x	x	x	x	x	x	24
Organazation management		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x			x	x		x	x	x			x	x				x	x	32
Assets		x		x		x			x	x					x	x			x	x								x							x						x	x	16
Costs	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	41
Revenue		x		x			x					x				x		x	x		x	x	x	x					x		x			x	x	x	x	x					x		21
Profit	x		x	x		x									x		x							x									x			x	x				x	x			14
Liability								x								x			x							x																		x	5
Source finance			x			x	x				x	x			x			x					x	x					x			x			x	x					x				14

Source: Author (2015)

Table 4. 23: Identifying key competitiveness indicators by Britain's top construction companies

International construction companie / Key competitiveness indicators	1 ABB LUMMUS GLOBAL, U.S.A	2 ABEINSA, Spain	3 ACCIONA SA, Spain	4 GRUPO ACS, Spain	5 AECOM, U. S. A.	6 AKER KVAERNER ASA, Norway	7 BALFOUR BEATTY, UK	8 BESIX SA, Belgium	9 BILFINGER BERGER AG, Germany	10 BLACK & VEATCH, U.S.A	11 BOUYGUES, France	12 CB&I, U.S.A	13 CH2M HILL COS. LTD, U.S.A	14 CLOUGH LTD, Australia	15 CONSOLIDATED CONTRACTORS, Greece	16 DANIELI, Italy	17 EIFFAGE, France	18 FCC, Spain	19 FERROVIAL, Spain	20 FLUOR, U.S.A	21 AMEC PLC, UK	22 HANJIN HEAVY, Korean	23 SALINI IMPREGILO SPA, Italy	24 JOANNOU & PARASKVAIDES, UK	25 JACOBS, U.S.A	26 JAN DE NUL, Luxembourg	27 JGC CORP, Japan	28 KAJIMA, Japan	29 KELLER GROUP, UK	30 KENTZ ENGINEERING AND	31 HOCHTIEF AG, Germany	32 LEND LEASE GROUP, UK	33 M+W GROUP GMBH, Germany	34 MAIRE TECNIMONT SPA, Italy	35 MCDERMOTT, USA	36 OBAYASHI, Japan	37 CONSTRUTORA NORBERTO ODEBRECHT,	38 OHL SA, Spain	39 PARSONS, U.S.A	40 PETROFAC, Channel Islands	41 ROYAL BAM GROUP, The Netherlands	42 SACYR VALLEHERMOSO, Spain	43 SAIPEM, Italy	44 SAMSUNG C&T CORP, S. Korea	45 SHIMIZU CORP, Japan	46 SKANSKA AB, Sweden	47 SNC-LAVALIN, Canada	48 SOLETANCHE BACHY, France	49 TAIKISHA LTD, Japan	50 TAKENAKA CORP, Japan	51 TECHNIP, France	52 TECNICAS REUNIDAS SA, Spain	53 The CONTRACTING & TRADING CO,	54 TRACTEBEL ENGINEERING, Belgium	55 VAN OORD, the Netherlands	56 VINCI, France	57 WORLEYPARSONS, Australia	58 KBR, U. S. A	59 BECHTEL, U.S.A	60 JOHN SISK& SON LTD, UK	cited number
Value-added for stakeholders	x		x	x			x		x		x				x				x	x	x						x	x		x			x						x									x	x	x	25
High productivity	x		x	x	x	x	x	x	x				x	x		x	x	x		x						x	x	x	x			x			x	x	x	x	x			x	x					x		x	x	x		38
Quality	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	56
Construction safety and environmental safeguards		x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	47
Social resposibility	x	x	x	x	x	x	x	x			x		x	x	x		x	x	x	x	x		x		x	x	x	x		x	x	x		x	x	x			x		x	x	x	x	x	x	x	x	x	x	x	x	45
Reputation		x		x	x		x	x	x		x		x	x		x	x	x		x	x	x		x	x	x			x	x	x	x	x	x	x			x																34
Corporate Culture	x	x		x	x	x	x	x	x		x			x	x		x	x		x	x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	48
Corporate experience	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	52
Employee management		x		x		x	x	x	x		x	x	x	x	x		x	x		x		x			x	x	x		x		x	x	x	x	x	x	x		x		x	x	x				x	x	x	x	x	39
Risk management	x	x		x	x	x	x	x	x		x		x	x	x		x	x		x	x		x			x	x	x		x	x	x		x	x	x			x		x	x	x				x	x	x			41
Cooperation and communication	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	52
Technology management	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	52
Information technology	x				x		x	x	x	x				x			x	x			x				x	x		x			x		x		x			x																22
R&D			x	x		x		x									x	x	x			x			x	x		x			x		x	x			x	x		x							x		x	x	x		29
Organazation management	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	55
Assets	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	x	x	x	x			x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x	46
Costs	x		x	x	x	x	x	x	x		x	x		x		x	x	x	x	x	x	x	x		x		x	x	x	x		x	x	x	x	x	x	x		x	x	x						x	x	x		41
Revenue	x			x		x	x		x			x		x			x	x		x	x	x			x	x		x	x	x		x	x	x	x	x	x		x	x	x							x	x			35
Profit	x		x	x	x			x	x								x		x					x						x		x	x	x			x	x													x	x			21
Liability	x	x		x	x	x	x	x	x					x			x	x			x				x		x		x			x	x	x			x	x		x											x	x	x		31
Source finance	x			x	x	x			x								x		x		x			x			x		x			x	x	x			x	x													x	x			26

Source: Author (2015)

Table 4. 24: Identifying key competitiveness indicators by top Chinese construction companies

Chinese construction companies / KCIs	1 CHINA STATE CONSTRUCTION ENG'G	2 CHINA PETROLEUM ENGINEERING & CONSTRUCTION CORP	3 CHINA CIVIL ENGINEERING CONSTRUCTION CORPORATION	4 CHINA COMMUNICATION CONSTRUCTION COMPANY	5 CHINA METALLURGICAL GROUP CORPORATION	6 CHINA RAIWAY CONSTRUCTION CORPORATION LIMITED	7 ZHONGYUAN PETROLEUM **(SINOPEC GROUP)**	8 DONGFANG ELECTRIC CORPORATION	9 SINOPEC ENGINEERING **(GROUP) CO. LTD.**	10 CHINA PETROLEUM PIPELINE BUREAU	11 SHANDONG ELECTRIC (SEPCOIII)	12 CGC OVERSEAS CONSTRUCTION GROUP	13 CHINA HARBOUR ENGINEERING COMPANY LTD.	14 CHINA NATIONAL MACHINERY & EQUIPMENT IMPORT & EXPORT	15 CHINA RAILWAY CORP LIMITED	16 SHANGHAI CONSTR. (GROUP) GENERAL	17 SINOHYDRO CORP	18 CHINA NATIONAL MACHINERY INDUSTRY CORPORATION	19 CHINA NATIONAL CHEMICAL CORPORATION	20 CHINA INTERNATIONAL WATER & ELECTRIC CORP.	21 CITIC CONSTRUCTION CO. LTD.	22 SHANGHAI ELECTRIC	23 CHINA GEZHOUBA GROUP CO. LTD	24 HARBIN POWER ENGINEERING COMPANY LTD.	25 CHINA GENERAL TECHNOLOGY GROUP	26 QINGJIAN GROUP(QINGDAO)	27 CHINA ROAD & BRIDGE CORP.	cited number
Value-added for stakeholders	x			x			x	x	x	x		x	x	x		x		x		x						x		13
High productivity	x	x	x	x	x			x	x	x	x		x	x	x	x	x		x	x	x			x	x	x	x	21
Quality	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x		x	x	x			x	x	x	x	22
Construction safety and environmental safeguards	x				x			x	x	x	x	x		x	x		x	x	x	x		x	x	x			x	x	17
Social resposibility	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	26
Reputation	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	24
Corporate culture	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	25
Corporate experience	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x		x						x	19
Employee management	x	x	x	x	x	x		x		x	x	x	x		x	x	x	x	x			x	x	x	x	x	x	22
Risk management	x													x	x			x			x		x					6
Cooperation and communication	x	x	x	x				x		x		x		x			x		x		x				x			12
Technology management	x	x	x		x	x	x		x	x			x		x	x	x	x	x	x		x	x	x	x	x		20
Information technology	x																	x						x				3
R&D	x	x		x	x	x	x	x	x	x					x	x		x	x	x		x	x	x	x	x		19
Organazation management	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	25
Assets	x			x		x	x	x	x	x					x	x		x				x	x		x			13
Costs				x					x		x												x					4
Revenue (turnover)	x			x	x	x	x	x	x	x				x	x	x		x				x	x		x	x		16
Profit	x					x		x	x	x					x	x		x				x	x		x			11
Liability	x			x	x	x	x	x	x	x					x	x		x				x						12
Source finance	x			x	x	x	x	x	x	x				x	x	x		x					x				x	14

Source: Author (2015)

Based on Tables 4.22—4.24, it can be seen that the top 10 KCIs were assessed as: quality, organisational management, safety, and a healthy environment, social responsibility, technology management, and a company's experience, communication and cooperation, costs, a company's culture and high productivity. The definition and the number of citations for each indicator have been shown in Table 4.25. Additionally, each indicator has been defined as KCI-X based on its ranking position, for example, quality is ranked No. 1 in the list, and so quality is designated as KCI-1.

Table 4. 25: The definition of KCIs, which emerged from the secondary literature review

KCIs	Definition	Total Number of citations
KCI-1 Quality	The project's quality met the requirements relating to standards or contracts.	120
KCI-2 Organisational management	Reasonable organisational structure; employees understood their responsibilities and rights concerning work; staff in the organisation were in collaboration with each other in order to effectively achieve organisational goals.	112
KCI-3 Construction safety and environmental safeguards	It was to protect employees, the public, the environment and to comply with applicable laws and protect the company's reputation. Companies were responsible for environmental protection, including occupational health and safety at work.	95
KCI-4 Social responsibility	Corporate responsibility to its stakeholders included employees, partners and consumers, companies should not only consider their own financial and business development, but should also consider the impact on society and the natural environment.	92
KCI-5 Technology management	The management of technical activities in engineering work. The basic task was to implement national technology policy, quality standards, norms, and regulations, demonstrating a clear responsibility of employees' technical activities, to meet the project's quality requirements, and developing new construction techniques.	92
KCI-6 Corporate experience	In which regions did the company operate? How many projects had the company finished? What kinds of projects had a company undertaken?	90
KCI-7 Cooperation and communication	Working together with other construction companies or academic institutions in order to promote more business opportunities.	89
KCI-8 Costs	Project costs: material costs, labour costs, and mechanical costs; company operating costs: wage, tax and R&D costs.	86
KCI-9 Corporate culture	Spiritual wealth was created by a company's operation and management activities, including employees' value, entrepreneurship and ethics.	84
KCI-10 High productivity	A comparison of the output of a production process to its corresponding input, that was, the output to input radio.	84
KCI-11 Value-added for stakeholders	Company needed to create value/ interests for all stakeholders, including not only stockholders, but also employees, communities, customers, partners, suppliers and even competitors.	80
KCI-12 Corporate reputation	A company's behaviour towards success might be recognized by society, including project reputation, service reputation, competition reputation, and financial reputation.	79
KCI-13 Assets	Tangible assets: including fixed and current assets. Such as inventory, foreign investment, monetary assets and accounts receivable; Intangible Assets: including patents, non-patented technology, trademarks, copyrights, land use rights and franchises.	75
KCI-14 Employee management	Development of manpower requirements planning, employee recruitment, employee training, salaries for management, employees' performance evaluation and employees' relationship with management.	73
KCI-15 Revenue	The income that a business received from its normal business activities.	72
KCI-16 Risk management	Risk definition, risk assessment, and risk responding to strategy development. The aim was to minimize, and, if possible, to avoid risk and reduce cost loss	72
KCI-17 Research and development	R&D consisted of investigative activities that a business chose to conduct with the intention of making a discovery that could either lead to the development of	72

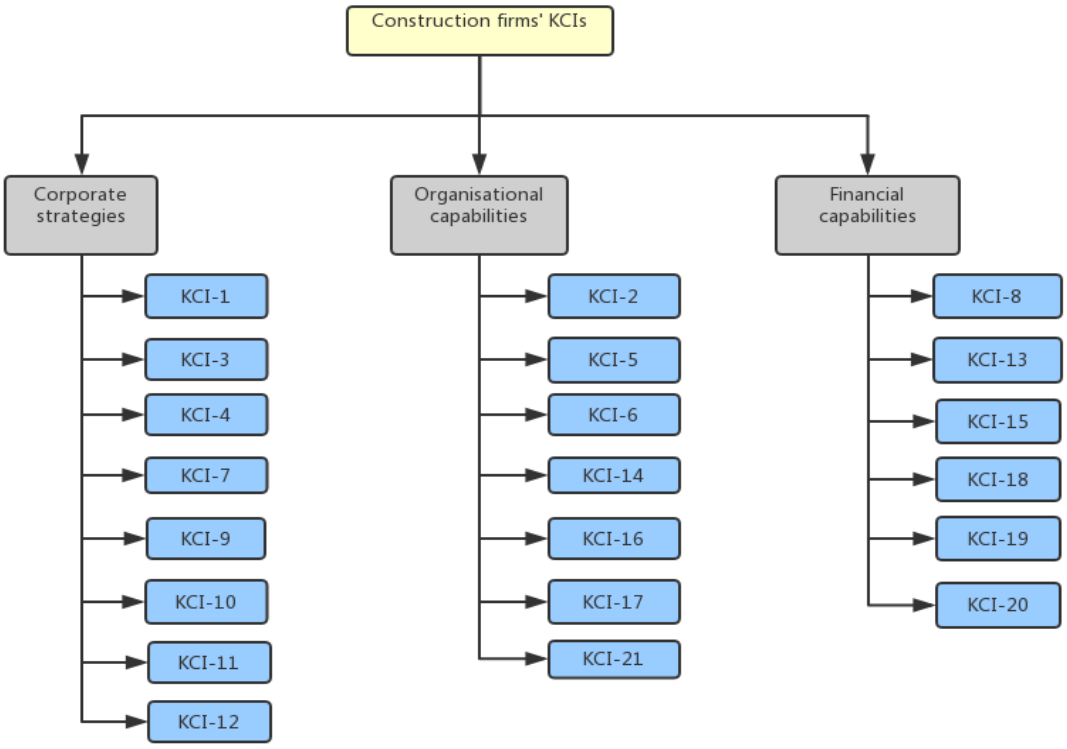
(R&D)	new products or procedures, or to the improvement of existing products or procedures. Research and development was one of the means by which business could experience future growth by developing new products or processes to improve, and to expand their operations.	
KCI-18 Sources of finance	The money available to a business for spending in the form of cash, liquid securities, and credit lines. Before going into business, an entrepreneur needed to secure sufficient financial resources in order to be able to operate efficiently, and sufficiently well to promote success.	54
KCI-19 Liabilities	When a company's operations required capital, without shareholders' support, banks or other lending institutions could support a loan, but would require a company to pay interest and repay all monies over a certain borrowing period.	48
KCI-20 Profit	Profit was a financial benefit that was realized when the amount of revenue gained from a business activity exceeded expenses, costs, and taxes needed to sustain the activity.	46
KCI-21 Information technology	It was the application of computers to store, retrieve, transmit and manipulate data, in order to improve both organisational management and project management.	37

Source: Author (2015)

Related to this analysis, a draft conceptual competitiveness framework (Figure 4.8) could be created. Those 21 KCIs have been divided into three clusters based on their concepts: corporate strategies, organisational capability, and financial capability. For example, KCI-1 Quality, KCI-3 Construction safety and environmental safeguards, and KCI-4 Social responsibility were placed in the cluster of corporate strategy, KCI-2 Organisational management, KCI-5 Technology management, and KCI-6 Corporate experience in the cluster of organisational capability; and KCI-8 Costs, KCI-13 Assets and KCI-15 Revenue were in the cluster of financial capability.

However, this draft framework required primary data collection and analysis; in the following research phases (exploratory chapter five and chapter six), in order to investigate the KCIs' performance that was reflected to an important degree in the CCFs' international competitiveness in the changing global construction market. Consequently, this framework's feasibility in practice will be demonstrated in chapter eight.

Figure 4. 8: The conceptual framework of construction firms' international competitiveness by the Analytical hierarchy process (AHP)



Source: Author (2015)

4.6 Summary

This chapter's structure has analysed the global construction market, and international competitiveness of CCFs by secondary resource literature, statistical data, and policy reports. The five questions of this chapter were answered.

It has been expected that the global construction market would grow over the next decade, although it was affected by a drop in oil price in 2014. Infrastructure would be the main segment for concern for international contractors in the global construction market, owing to some countries' support for infrastructure construction to stimulate their countries' economies, such as: China, Japan and Brazil. Western Europe's recovery from depression, could result in more projects being available for international contractors, moreover, based on an analysis of international revenue over the past decade and policy reports, the Asian market could focus on the construction market over the next decade. However, China's construction market could be affected by its economic slowdown in 2015, perhaps, China's market was not balanced enough for international contractors to invest in. The uncertainty and dynamic changes surrounding global construction, including, for example: the identification of contractors, financial resources,

regulations, and political conditions. These changing issues could affect global construction firms' international operational performance. The changing global market required construction firms to gain market information and to respond to changing issues quickly; otherwise, construction firms would not be able to adapt to any rapid development in the market.

"Open door" has been the cornerstone of China's economic transformation, it eased the way for Chinese companies to "go out" and attract international companies to invest in China. Before the 1980s, when China implemented its "open-door" policy and economic reforms, CCFs obtained almost everything from the government, including assignments of projects, materials, and free allocated finance for work. They had no motivation because they were not allowed to make profits. During the period, there was no competition in the construction business, because the construction industry was considered a non-profit-making sector in the national economy, therefore, CCFs were not a competitive entity. With the reform of the economy and the introduction of market competition, China transformed its government institutions in order to effectively promote the construction industry's development, and formulate relevant policies and regulations to monitor the activities in construction, such as: Construction Law, qualification systems for enterprises and professionals, and regulations in quality management. Moreover, CCFs were required to adapt to a market economy and gain competitive advantage by reforming themselves to be more commercial. During this adaptation, construction firms were given more freedom. Alongside the extra freedom was that construction companies were forced to hunt for work in a competitive market. They needed to improve competitiveness to survive in the market. Turning construction firms from non-profit to profitable entities, was one of the typical strategies adopted to enhance competitiveness during the transition period. Currently, it is generally considered that internationalisation organisation management has been widely established in CCFs. Most CCFs were running their business in a similar way to their Western counterparts.

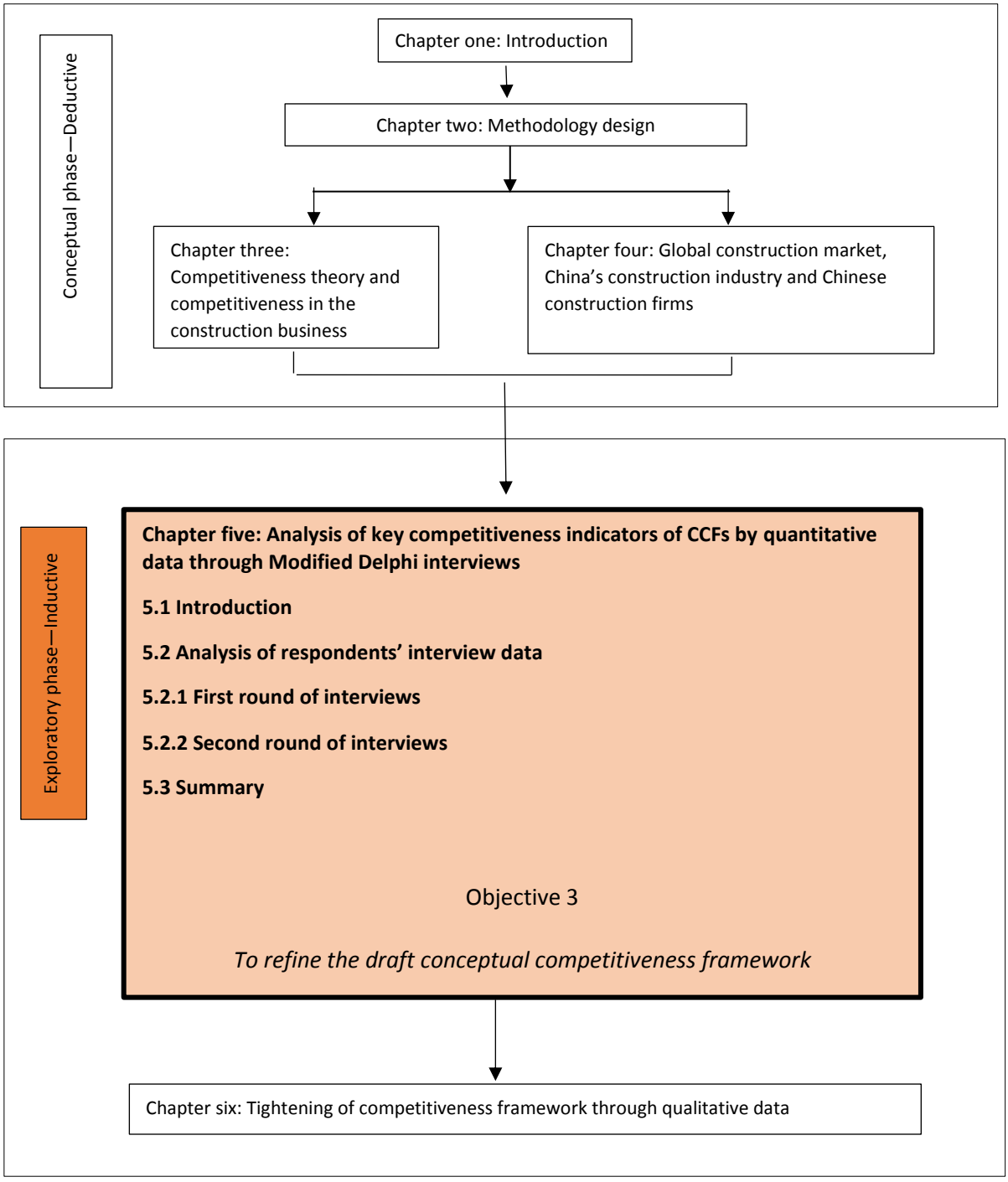
European contractors were key players in the global market at present, seven European contractors have been ranked in the top 10 international contractors and they have achieved higher international revenue than other regions' contractors. Chinese contractors' international revenue accounted for a small amount of total revenue; the main revenue was accrued from Chinese projects. As a result, it was considered important to examine the operation of the top international contractors in the global market. A total of 27 CCFs were ranked in the Top 100 international contractors over the past decades, all of them being state-owned enterprises. Only two private Chinese enterprises were ranked in the Top 10 Chinese contractors in the domestic market, this showed that key players in China's construction market were still large state-owned enterprises.

The CCFs international competitiveness were analysed by a SWOT analysis model; this indicated that CCFs have strengthened their position in the global construction market. The international competitiveness of Chinese construction firms has improved through financial support from government, competitive bidding prices, and low costs, human resource capabilities, advanced technology, and the relationship and assignment of projects by government directive; these factors empowered Chinese contractors to expand their business abroad.

Based on the literature review, the key competitiveness indicators could be identified 21 KCIs were identified from a key academic paper assessing construction firms' annual reports, including quality, organisational management, construction safety and environmental safeguards, social responsibility, technology management, corporate experience, communication and cooperation, costs, corporate culture, and high productivity. A draft conceptual competitiveness framework was established through these 21 KCIs. However, an important degree of those 21 KCIs was to investigate the exploratory phase, and the draft conceptual competitiveness framework was necessary to be refined with respect to the primary data analysis.

Chapter Five

Analysis of the key competitiveness indicators of Chinese construction firms through Modified Delphi interviews



5.1 Introduction

In last chapter, development trends and changing issues in the global construction market, charting the transformation and development of China's construction industry and Chinese Construction Firms (CCFs), and the key players in both global and China's construction market have been investigated. A draft conceptual competitiveness framework (Figure 4.8) was established through the 21 Key Competitiveness Indicators (KCIs), which emerged from the secondary literature review of 48 academic papers, and materials from 60 international construction firms and 27 CCFs.

The aim of this chapter was to refine mainly the importance of KCIs regarding CCFs' success based on the interview results. The sample selection was illustrated in section 2.4.2.1, the Modified Delphi interviews were conducted with 32 Chinese construction industry experts (Appendix I). These included 14 participants from CCFs, which were ranked in the top 100 global construction firms during the last decade. Additionally, 18 participants were from outside the top 100 construction firms, including 14 interviewees who had experience in overseas project operations, two UK scholars and two Chinese scholars who were considered to be authorities concerning this topic.

According to Modified Delphi method requirements, the iterations of the Delphi exercise allowed participants to adjust their scores of the KCIs after learning of the scores of the other participants. This led to the establishment of an Analytical Hierarchy Process (AHP) framework, in which KCIs could improve CCFs' international competitiveness in overseas markets.

5.2 Analysis of respondents' interview data

An analysis of the primary quantitative data predicated from the interview results have been outlined. Two rounds of interviews were conducted in order to achieve consensus among all the participants. In the first round of interviews, three sections were conducted: first, open-end questions that rated the literature review's KCIs (emerging from literature in chapter four) with further KCIs being added. In the second round of interviews, two sections were conducted: the re-rating of the literature review's KCIs based on the first interviews results along with rating of the additional KCIs, which were proposed in the first interviews.

Chapter two illustrated the details of the methods of analysis. SPSS was applied to analyse the rating scores. A Delphi study required the place of consensus to be established at the start of the study (Crisp *et al.* 1997). Consideration must be given to the level of consensus employed (Hasson *et al.* 2000). To achieve consensus, four sets of combined criteria measures were used including: median score of ≥4.00, mean score of ≥3.00, the interquartile range (IQR) ≤1.00 or less, and the standard deviation (SD) ≤ 1.00 on a 5-point scale (Geist 2010).

For the level of agreement and stability, the stopping criteria followed Kendall's coefficient of concordance *W*. Kendall's *W* should be ≥ 0.500 (Cafiso *et al.* 2013), however, if *W* was less than 0.500, the interview must be repeated with all participants taking part.

5.2.1 First round of interviews

In the first round, interviewees were asked to answer three open-end questions, in order to allow the author understand their opinions about CCFs' successful overseas operations. These three questions' answers have been analysed in the next chapter, combined with reference to the literature review to illustrate the important KCIs. Secondly, the interviewees were asked to rate the important degree of KCIs, which emerged from the secondary literature review and were explained the reasons for each KCI's rating. Moreover, they were asked to provide additional KCIs, which they considered contributed to a firm's international competitiveness.

5.2.1.1 Analysis of the KCIs rating

In the first round, consensus was reached on 20 out of the 21 key competitiveness indicators, but the assets' IQR score was 1.75 >1, thus, assets did not achieve consensus (Table 5.1). However, Kendall's *W*=0.208 indicated that the level of agreement among those interviewees was weak. This required carrying out a second round of interviews to achieve agreement. The KCIs rating of each participant and SPSS reports are shown in Appendix VII.

Table 5. 1: The results of KCIs rating from the first round of interviews

KCIs	Maximum	Minimum	Mean	Median	IQR	SD	Total value
KCI-1. Project quality	5	4	4.781	5	0	0.420	153
KCI-3. Construction safety and environmental safeguards	5	3	4.563	5	1	0.564	146
KCI-4. Social responsibility	5	1	3.906	4	0.75	0.856	125
KCI-7. Communication and cooperation	5	2	3.813	4	1	0.821	122
KCI-9. Corporate culture	5	3	3.875	4	0	0.554	124
KCI-10. High productivity	5	3	4.375	4	1	0.609	140
KCI-11. Valued-added for stakeholders	5	2	3.719	4	1	0.924	119
KCI-12. Reputation	5	3	4.531	5	1	0.621	145
KCI-2. Organisation management	5	3	4.500	5	1	0.622	144
KCI-5. Technology management	5	3	4.438	4	1	0.564	142
KCI-6. Corporate experience	5	3	3.906	4	0	0.588	125
KCI-14. Employee management	5	2	4.063	4	1	0.759	130
KCI-16. Risk management	5	3	4.281	4	1	0.581	137
KCI-17. Research and Development	5	2	4.313	4	1	0.780	138
KCI-21. Information technology	5	3	4.063	4	0.75	0.669	130
KCI-8. Costs	5	2	4.125	4	1	0.707	132
KCI-13. Assets	5	3	3.938	4	1.75	0.759	126
KCI-15. Revenue	5	2	4.000	4	0	0.672	128
KCI-18. Source of finance	5	2	3.875	4	0.75	0.707	124
KCI-19. Liability	5	2	3.531	4	1	0.718	113
KCI-20. Profit	5	3	4.094	4	1	0.689	131

Source: Author (2016)

5.2.1.2 The additional key competitiveness indicators

In this round of interviews, the interviewees were asked to propose additional KCIs, which they considered important for the CCFs' international competitiveness. The Table 5.2 revealed these additional KCIs and the explanation of their importance was given by the interviewees. These KCIs' degree of importance will be rated in the next round of interviews.

Table 5. 2: Additional KCIs which participants proposed in the first round of interviews

Additional KCIs	The definitions of KCIs
KCI-22 The ability of information acquisition	Mr A said: "the market is changing every day, different markets have different demands, so it is very important that a construction company has the ability to acquire the changing market's information, this facilitates a company's exploration for more business opportunities in the overseas markets."
KCI-23 China's political influence	Mr B illustrated: "In my view, it is not enough only to focus on competitiveness indicators inside at the firm's level, the Chinese can undertake overseas projects because of Chinese government's bilateral trade, so I think indicators about national policy and the countries' relationships are very important for Chinese construction firms." Lecturer AC explained: "China's political position in the world facilitates Chinese companies' entry into the global market, because China is seeking to establish economic partners with other countries, for example, the 'One Belt One Road' economic area and the Asian Infrastructure Investment Bank, are business opportunities for Chinese companies." Lecturer AD described: "CCFs cannot operate a lot of projects in the international market without the Chinese government's support, China's political influence encourages the Chinese government's agreements in respect of bilateral trade with other countries, so China's political influence is an important competitiveness index for Chinese construction firms."
KCI-24 The relationship between China and other countries	Mr B illustrated: "In my view, it is not enough to only focus on competitiveness indicators inside at firm's level, the Chinese can undertake overseas projects because of the Chinese government's bilateral trade, so I think the indicators about national policy and the countries' relationships with China are very important for Chinese construction firms."
KCI-25 Nation's protectionism	Mr B said: "every country must protect its own business trade chain. International investment could bring risks into host countries, so host countries' protectionism could affect the Chinese exploration of their market."
KCI-26 Safety management	Mr B supposed: "safety management regarding a project's safety, staff's safety and the surrounding residents' safety; it is the duty of construction companies' requirements to undertake such measures." Mr V pointed out that safety is the main issue on-site; a company must pay attention to a construction project's safety.
KCI-27 Financing methods	Ms. I said: "I think the financing method is necessary to be considered, because different financing methods have different debt and payback periods, it could affect a company's financial performance."
KCI-28 Bidding price	Ms. J thought: "at present, undertaking an overseas project is the main method for Chinese construction firms entering the international market, thus, bidding price, and the method of cost control are important."
KCI-29 Cost control	Ms. J said: "at present, undertaking an overseas project is the main method for Chinese construction firms entering the international market, thus, bidding price, and the method of cost control are important."
KCI-30 Project warranty	Mr M explained: "it is important for construction firms to support a project warranty for investors and clients, it could ensure a project's quality during the period of the project. By implementing this measure a construction company can

	achieve more trust from investors and clients."
KCI-31 National policy	Mr M said: "Chinese construction firms operate overseas projects based on the Chinese government's bilateral contracts, so national policy is an important factor, we cannot enter the international market without government support." Lecturer AC described that the Chinese government's policy is important, because it affect what kinds of projects the Chinese can undertake overseas, which markets the Chinese could enter assisted by government trade, and how much funding companies could gain from international operations.
KCI-32 The level of Internationalisation	Mr N explained: "it means the proportion of international revenue compared with total revenue, how much international revenue a company makes annually, which can show the company's achievement in the international market, so this is an important indicator when considering a company's international competitiveness."
KCI-33 Understanding the international construction market	Mr P said: "if construction firms want to explore the international market, it is very important to have an understanding of the demands or requirements in the international market first, otherwise, companies could not operate successfully and could not win projects."
KCI-34 Quality assurance	Mr P said: "Quality is the most important task for a Construction Company; all construction firms have their own procedures to control project quality. However, are Chinese companies' procedures useful in overseas markets? Thus, companies must align their own procedures to meet international quality assurance's requirements, for example, the ISO 9000, in order to achieve better performance in overseas projects."
KCI-35 The ability to apply advanced technologies	Mr Q described: "Staff must accept and apply advanced technologies because that is the basis of advanced technologies so that they can be utilized in projects."
KCI-36 the choice of selection of construction technology in the preliminary construction scheme	Mr R said: "all projects are required to design a construction scheme before starting construction, it is very important for project managers to design a construction scheme based on a construction technology's plan, it could help a project manager's forecast of potential risks in the project's programme and ensure projects would apply appropriate technologies."
KCI-37 Leadership	Mr T explained that all businesses in Chinese enterprises are determined by company managers, thus, a Company manager's leadership could affect an organisation's management and company culture, so a company manager's leadership is very important.
KCI-38 The training and welfare of expatriate personnel	Mr T considered: "a lot of staff do not want to work abroad, because they feel some developing countries are not safe, and the salary is not worth it. Moreover, some staff who work overseas do not have enough knowledge about the global construction market. Thus, company must train staff about overseas construction knowledge and improve welfare to attract staff to work abroad."
KCI-39 Contract management	Mr V illustrated: "a project operation is based on the contract, which a construction company signs with investors, thus, it is very important for the construction team to have good contract management, and to ensure project management follows the contract requirements."

KCI-40 Information management	Mr V pointed out: "a company must have an information platform to improve staff's communication and update project progress information, if a company's staff cannot communicate well, this could affect a project's progress and staff's working-efficiency."
KCI-41 Considerations of claims on the project	Mr X said: "some risks cannot be forecast in the bidding phase, a company must have good knowledge of any claims on the project if any breaches of contract have happened."
KCI-42 Knowledge of the project countries' accounting and tax systems	Mr Y said: "we are required to pay tax to project countries, thus it is important we know their accounting and tax systems."
KCI-43 Employees' quality	Mr Z considered: "it is very important for a company to recruit high quality staff for international businesses. High quality employees contribute to achieving a company's aims, moreover, high quality employees make working together easier in a harmonious working environment."
KCI-44 Employee localisation	Mr AA thought: "for international projects, it is important to employ local people, first, local people know the local market well; and sometimes, the costs of employing local people are cheaper than Chinese expatriates in the international market."
KCI-45 Company's qualification	Ms. AB said: "a company's qualifications reveal a construction company's capability in the project, this is an important factor in the bidding phase."
KCI-46 The strategy of bidding	Ms. AB said: "the first step for entry into a market is to win the project, so strategies for bidding are very important."
KCI-47 The political environment of project countries	Ms. AB supposed: "most projects take place in developing countries, thus, the political environment in the project's countries is very important. It could affect the relationship between the project countries and China, and thus it could affect Chinese companies' entry into project countries. Moreover, if the project countries' political environment is not peaceful, it could affect Chinese workers' safety."
KCI-48 Agility/adaptability/responses	Professor AE illustrated the need to: "quickly understand the market, for example, Chinese construction firms' staff are embedded into the African living environment. Comparisons between the Chinese and Western adaptations to the local people and their environment; for example in: Nigeria, Gabon, Senegal. Communication is vital. The transference or externalisation of the company's culture to those on the ground in the local context is vital."
KCI-49 Management change	Professor AE explained: "a construction company wants to run projects, so you are able to manage change, because you are coming to a new place, everything around you is different from your own country, so many changes around you, you need to manage these changes. To be able to manage change; the context for any form of operation is different and needs managing."
KCI-50 Regulations and legal frameworks	Professor AE noted: "entry into a new market needs an understanding of its regulations and legal frameworks. An understanding of the context of those in the new country is necessary."
KCI-51 Understanding local values and idiosyncrasies	Professor AE stated: "they will be different; for example: locally accepted forms of oral communication; body language; conduct in meetings."
KCI-52 Corporate knowledge	Senior Lecturer AF considered: "regarding locations; types of projects; other countries they have worked in; major

	projects inside China; joint ventures; financial management; senior managers who understand this market / western consumer culture are very important for these companies to make an impact in this market."
KCI-53 Brand	Senior Lecturer AF wondered: "is there a perception of 'brand'? I think that China is moving into this phase now. I have always said that China was the electronics workshop for the world, but it doesn't have its own brand. I think that Chinese brands, for example, Lenovo, have got to become mainstream like Kia, Honda, Hyundai and Subaru. Consumer culture is all about identifying with 'brand': construction companies will have to establish a sense of brand, such as, McAlpine, Laing, Taylor-Woodrow – this does not yet exist for Chinese construction companies and they need to come to British exhibition centres in order to promote their presence in a positive way so that when clients think of 'construction' they will think of their brand. Construction is about physically and psychologically establishing a sense of trust – having a brand is about establishing a sense of trust and security."

Source: Author (2016)

5.2.2 Second round of interviews

As the Kendall's *W* of KCIs was less than 0.500 in the first round of interviews, the additional KCIs were proposed by interviewees. Therefore, it was necessary to conduct a second round of interviews, in order to achieve good consensus among all interviewees.

5.2.2.1 Re-rating the 21 KCIs' degree of importance

In this round, the author first explained the reasons of KCIs' rating in the first round interviews to participants, and then, the interviewees could either keep their first round ratings or change their ratings if they considered the other participants' ratings more reasonable (Table 5.3). Moreover, they were required to rate the additional KCIs (Table 5.4). The KCIs' rating of each respondent and the SPSS report are shown in Appendix VIII.

Table 5. 3: The results of KCIs rating in the second round interviews

KCIs	Maximum	Minimum	Mean	Median	IQR	SD	Total value
KCI-1. Project quality	5	4	4.933	5	0	0.254	158
KCI-3. Construction safety and environmental safeguards	5	4	4.901	5	0	0.296	157
KCI-4. Social responsibility	5	1	3.906	4	0	0.641	125
KCI-7. Communication and cooperation	5	3	4.063	4	0	0.435	130
KCI-9. Corporate culture	5	3	4.031	4	0	0.309	129
KCI-10. High productivity	5	4	4.250	4	0.75	0.440	136
KCI-11. Valued-added for stakeholders	5	2	3.906	4	0	0.530	125
KCI-12. Reputation	5	4	4.844	5	0	0.369	155
KCI-2. Organisational management	5	4	4.813	5	0	0.397	154
KCI-5. Technology management	5	3	4.719	5	0.75	0.523	151
KCI-6. Corporate experience	5	3	3.969	4	0	0.309	127
KCI-14. Employee management	5	2	4.031	4	0	0.538	129
KCI-16. Risk management	5	4	4.094	4	0	0.296	131
KCI-17. Research and Development	5	3	4.156	4	0	0.448	133
KCI-21. Information technology	5	3	3.969	4	0	0.400	127
KCI-8. Costs	5	3	4.125	4	0	0.421	132
KCI-13. Assets	5	3	4.000	4	0	0.440	128
KCI-15. Revenue	5	3	4.031	4	0	0.400	129
KCI-18. Source of finance	5	3	3.969	4	0	0.400	127
KCI-19. Liability	4	3	3.406	3	1	0.499	109
KCI-20. Profit	5	4	4.219	4	0	0.420	135

Source: Author (2016)

Kendall's *W*=0.531 > 0.500, indicated that all participants achieved a good consensus in this round of interviewees, and the 21 KCIs' ratings could be concluded. 1 out of the 21 KCIs that did not achieve consensus was liability as liability's median score = 3 less than 4, thus, liability must be removed from the key competitiveness indicators list. According to Table 5.3, the KCIs could be ranked by their mean score, see Table 5.4, if two or more KCIs had the same mean score, the lower standard of deviation was awarded a higher rank.

Table 5. 4: KCIs ranking by the mean scores of the interview results

Rank	**KCIs**	**Mean**	**SD**
1	KCI-1. Project quality	4.938	0.246
2	KCI-3. Construction safety and environmental safeguards.	4.901	0.296
3	KCI-12. Reputation	4.844	0.369
4	KCI-2. Organisational management	4.813	0.397
5	KCI-5. Technology management	4.719	0.523
6	KCI-10. High productivity	4.250	0.440
7	KCI-20. Profit	4.219	0.420
8	KCI-17. Research and Development	4.156	0.448
9	KCI-8. Costs	4.125	0.421
10	KCI-16. Risk management	4.094	0.296
11	KCI-7. Communication and cooperation	4.063	0.435
12	KCI-9. Corporate culture	4.031	0.309
13	KCI-15. Revenue	4.031	0.400
14	KCI-14. Employee management	4.031	0.538
15	KCI-13. Assets	4.000	0.440
16	KCI-6. Corporate experience	3.969	0.309
17	KCI-21. Information technology	3.969	0.400
18	KCI-18. Source of finance	3.969	0.400
19	KCI-11. Valued-added for stakeholders	3.906	0.530
20	KCI-4. Social responsibility	3.906	0.641

Source: Author (2016)

However, the interview results showed that these KCIs' rankings were different from those in the secondary literature review (see Table 4.25). Table 5.5 below illustrated the gap between the literature and practice.

Table 5. 5: Comparison of KCIs rankings in the literature cited and in the interview results.

Rank	Secondary literature review results	Interview results
1	KCI-1 Project quality	KCI-1 Project quality
2	KCI-2 Organisation management	KCI-3 Construction safety and environmental safeguards
3	KCI-3 Construction safety and environmental safeguards	KCI-12 Reputation
4	KCI-4 Social responsibility	KCI-2. Organisational management
5	KCI-5 Technology management	KCI-5. Technology management
6	KCI-6 Corporate experience	KCI-9 High productivity
7	KCI-7 Communication and cooperation	KCI-20 Profit
8	KCI-8 Costs	KCI-17 Research and Development
9	KCI-9 High productivity	KCI-8 Costs
10	KCI-10 Corporate culture	KCI-16 Risk management
11	KCI-11 Value-added for stakeholders	KCI-7 Communication and cooperation
12	KCI-12 Reputation	KCI-11 Corporate culture
13	KCI-13 Assets	KCI-15 Revenue
14	KCI-14 Employee management	KCI-14 Employee management
15	KCI-15 Revenue	KCI-13 Assets
16	KCI-16 Risk management	KCI-6 Corporate experience
17	KCI-17 Research and development	KCI-21 Information technology
18	KCI-18 Source of finance	KCI-18 Source of finance
19	KCI-19 Liability	KCI-11 Valued-added for stakeholders
20	KCI-20 Profit	KCI-4 Social responsibility
21	KCI-21 Information technology	

Source: Author (2016)

Social responsibility was ranked No.4 in the secondary literature review results, but it was ranked No. 20 in the interview results. This illustrated the CCFs' lack of social responsibility in practice. However, the secondary literature review results (Table 4.24) demonstrated that 26 out of 27 CCFs mentioned social responsibility in their annual reports. This can be interpreted in the following way: that CCFs were paying attention to social responsibility over the past 10 years, but their employees still lacked a measure of social responsibility understanding, just as Mr Z, manager of the project department in the NT10 Group, mentioned, social responsibility was a vague idea in Chinese companies. They did not clearly understand the meaning of social responsibility and they did not know how to undertake social responsibility. Consequently, the author considered that CCFs must first improve their employees' social responsibility understanding, otherwise, CCFs could not undertake social responsibility successfully in the construction market in the future.

Corporate experience was ranked No. 6 in the secondary literature review results, but it was ranked No. 16 in the interview results. 52 out of 60 international construction firms (Table 4.23) mentioned corporate experience was important for their businesses. However, the CCFs' interviewees had different opinions. Mr Q, assistant manager of the marketing department in NT3 Ltd., commented that corporate experience was important to some extent, it could help a company know the market well; but experience in one nation might not transfer to another nation, for example, experience in developing countries might not be suitable for developed ones. The author concurred CCFs could not achieve success in the global market only based on their previous operational experience. The global construction market was changing and development was rapid, it required construction firms quickly to respond to its changes and development.

Value-added for stakeholders was ranked No.11 in the literature results. However, it ranked No. 19 in the interviews results. From the interviews, the author found that many of the CCFs' interviewees lacked ideas as to what constituted value-added for stakeholders. Some of them could not describe the meaning of value and some of them could not identify who were stakeholders; they confused stakeholders with shareholders. Only one participant, Mr X, manager of the project department in NT8 Corp. noted that his company's aim was "creating value with clients together". The secondary literature review results showed that value-added for stakeholders was one of the key points in academic papers; in 42 out of 48 academic papers concerning competitiveness it was mentioned (Table 4.22). However, it was not a crucial point for construction firms, only 25 out of 60 international construction firms (Table 4.23) and 13 out of 27 CCFs (Table 4.24) mentioned it in their reports. Therefore, the author considered that global construction firms, as economic units, must focus on their stakeholders' value, because it related to stakeholders' trust.

Reputation was ranked No.12 in the literature review results, but by comparison it was ranked No. 3 in the interview results. It can be shown that CCFs paid attention to their reputation in the market. Mr T stated: "*reputation not only enhances a company's trust in the market, but also encourages company staff to improve their working motivation, because staff could feel honour to work in a famous company.*"

5.2.2.2 Additional KCIs' ratings in the second rounds of interviewees

Some participants proposed 32 additional KCIs in the first round of interviews (see Table 5.2). Therefore, the participants were required to rate these additional KCIs' in their degree of importance. See Table 5.6. The details of KCIs' ranking and in the SPSS reports are shown in Appendix VIII.

Table 5. 6: The results of additional KCIs rating

KCIs	Max	Min	Mean	Median	IQR	SD	Total value
KCI-22. The ability of information acquisition	5	4	4.219	4	0	0.420	135
KCI-23. China's political influence	5	2	4.031	4	0	0.595	129
KCI-24. The relationship between China and other countries	5	3	4.125	4	0	0.421	132
KCI-25. Nation's protectionism	5	2	3.281	3	1	0.581	105
KCI-26. Safety management	5	3	4.719	5	0.75	0.523	151
KCI-27. Financing methods	5	3	4.094	4	0	0.466	131
KCI-28. Bidding price	5	4	4.781	5	0	0.420	153
KCI-29. Cost control	5	4	4.188	4	0	0.397	134
KCI-30. Project warranty	5	4	4.125	4	0	0.336	132
KCI-31. National policy	5	4	4.093	4	0	0.296	131
KCI-32. The level of internationalisation	5	3	4.094	4	0	0.466	131
KCI-33. Understanding the international construction market	5	4	4.813	5	0	0.397	154
KCI-34. Quality assurance	5	4	4.781	5	0	0.420	153
KCI-35. The ability to apply advanced technologies	5	4	4.813	5	0	0.397	154
KCI-36. The choice of selection of construction technology in the preliminary construction scheme	5	3	4.750	5	0	0.508	152
KCI-37. Leadership	5	3	4.250	4	1	0.508	136
KCI-38. The training and welfare of expatriate personnel	5	2	4.000	4	0	0.508	128
KCI-39. Contract management	5	4	4.875	5	0	0.336	156
KCI-40. Information management	5	4	4.219	4	0	0.420	135
KCI-41. Consideration of claims on the project	5	2	3.219	3	0	0.608	103
KCI-42. Knowledge of the project countries' accounting and tax systems	5	3	4.000	4	0	0.440	128
KCI-43. Employees' quality	5	4	4.188	4	0	0.397	134
KCI-44. Employee localisation	5	3	4.000	4	0	0.360	128
KCI-45. Company's qualification	5	2	3.250	3	0	0.672	104
KCI-46. The strategy of bidding	5	2	4.750	5	0	0.622	152
KCI-47. The political environment of project countries	5	3	3.969	4	0	0.474	127
KCI-48. Agility/adaptability/responses	5	2	4.031	4	0	0.538	129
KCI-49. Management change	5	2	4.719	5	0	0.634	151
KCI-50. Regulation and legal framework	5	3	3.969	4	0	0.400	127
KCI-51. Understanding local values and idiosyncrasies	5	1	4.031	4	0	0.695	129
KCI-52. Corporate knowledge	5	4	4.313	4	1	0.471	138
KCI-53. Brand	5	4	4.844	5	0	0.369	155

Source: Author (2016)

The Kendall's W of additional KCIs=0.509 > 0.500, Consequently, the additional KCIs rating could be concluded. However, 3 out of 32 KCIs did not achieve consensus, there were a nation's protectionism, consideration of claims on the project, and the company's qualifications, their median=3 < 4. This revealed that most participants considered they were not very important for the construction firms' international competitiveness. Therefore, these three indicators must be removed from the key competitiveness indicator lists.

The Modified Delphi interviews were finished after two rounds because the KCIs' ratings achieved good consensus. Just as Iqbal and Pipon-Young (2009) suggested: a two-round Delphi was most suitable, when a questionnaire emerged from a clear literature review. Based on the interviewees' KCIs results (Table 5.3 and Table 5.6), the KCIs could be ranked by their mean scores. If two or more KCIs had the same mean scores, the one with a lower standard of deviation (SD) would be allocated a higher rank. The ranking results are shown in Table 5.7.

Table 5. 7: KCIs' rankings by their mean scores.

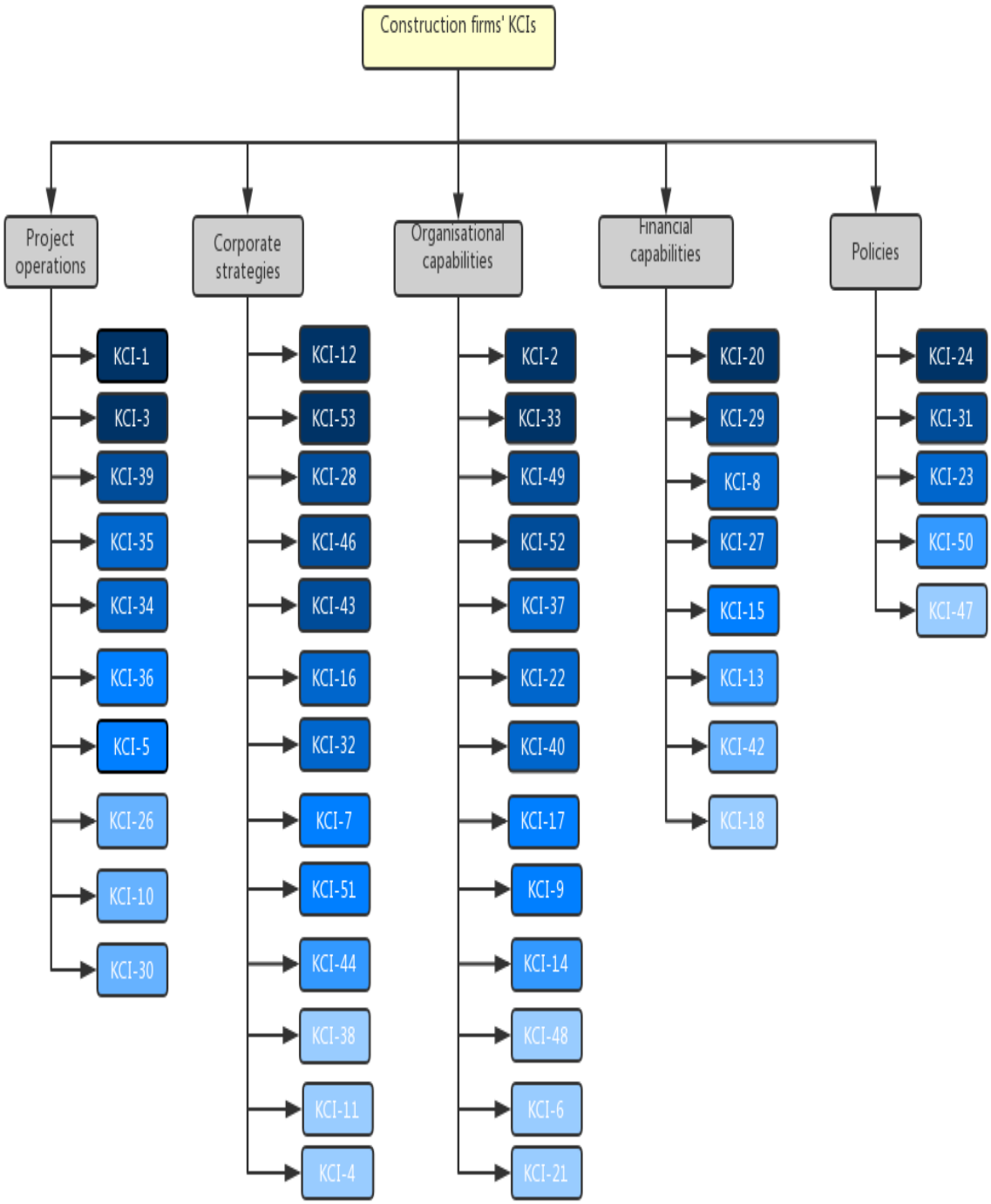
Rank	KCIs	Mean	SD	Total value
1	KCI-1 Project quality	4.938	0.246	158
2	KCI-3 Construction safety and environmental safeguards.	4.901	0.296	157
3	KCI-39 Contract management	4.875	0.336	156
4	KCI-12 Reputation	4.844	0.369	155
5	KCI-53 Brand	4.844	0.369	155
6	KCI-2 Organisational management	4.813	0.397	154
7	KCI-33 Understanding the international construction market	4.813	0.397	154
8	KCI-35 The ability to apply advanced technologies	4.813	0.397	154
9	KCI-28 Bidding price	4.781	0.420	153
10	KCI-34 Quality assurance	4.781	0.420	153
11	KCI-36 The choice of selection of construction technology in the preliminary construction scheme	4.750	0.508	152
12	KCI-46 The strategy of bidding	4.750	0.622	152
13	KCI-5 Technology management	4.719	0.523	151
14	KCI-26 Safety management	4.719	0.523	151
15	KCI-49 Management change	4.719	0.634	151
16	KCI-52 Corporate knowledge	4.313	0.471	138
17	KCI-10 High productivity	4.250	0.440	136
18	KCI-37 Leadership	4.250	0.508	136
19	KCI-20 Profit	4.219	0.420	135
20	KCI-22 The ability of information acquisition	4.219	0.420	135
21	KCI-40 Information management	4.219	0.420	135
22	KCI-29 Cost control	4.188	0.397	134
23	KCI-43 Employees' quality	4.188	0.397	134
24	KCI-17 Research and Development	4.156	0.448	133
25	KCI-30 Project warranty	4.125	0.336	132
26	KCI-8 Costs	4.125	0.421	132
27	KCI-24 The relationship between China and other countries	4.125	0.421	132
28	KCI-16 Risk management	4.094	0.296	131
29	KCI-27 Financing methods	4.094	0.466	131

30	KCI-32 The level of internationalisation	4.094	0.466	131
31	KCI-31 National policy	4.093	0.296	131
32	KCI-7 Communication and cooperation	4.063	0.435	130
33	KCI-9 Corporate culture	4.031	0.309	129
34	KCI-15 Revenue	4.031	0.400	129
35	KCI-14 Employee management	4.031	0.538	129
36	KCI-48 Agility/adaptability/responses	4.031	0.538	129
37	KCI-23 China's political influence	4.031	0.595	129
38	KCI-51 Understanding local values and idiosyncrasies	4.031	0.695	129
39	KCI-44 Employee localisation	4.000	0.360	128
40	KCI-13 Assets	4.000	0.440	128
41	KCI-42 Knowledge of the project countries' accounting and tax systems	4.000	0.440	128
42	KCI-38 The training and welfare of expatriate personnel	4.000	0.508	128
43	KCI-6 Corporate experience	3.969	0.309	127
44	KCI-21 Information technology	3.969	0.400	127
45	KCI-18 Source of finance	3.969	0.400	127
46	KCI-50 Regulations and legal frameworks	3.969	0.400	127
47	KCI-47 The political environment of project countries	3.969	0.474	127
48	KCI-11 Valued-added for stakeholders	3.906	0.530	125
49	KCI-4 Social responsibility	3.906	0.641	125

Source: Author (2016)

Therefore, the draft conceptual competitiveness framework (Figure 4.8) with three clusters: corporate strategies, organisational capabilities, and financial capabilities could be refined by reference to those 49 KCIs. However, based on the definitions of those 49 KCIs, the competitiveness framework could be separated into five clusters: project operations, corporate strategies, organisational capabilities, financial capabilities, and policies (Figure 5.1). The KCIs in each cluster have been organised by the rankings of their mean scores (Table 5.7).

Figure 5. 1: Refining the draft conceptual competitiveness framework



Source: Author (2016)

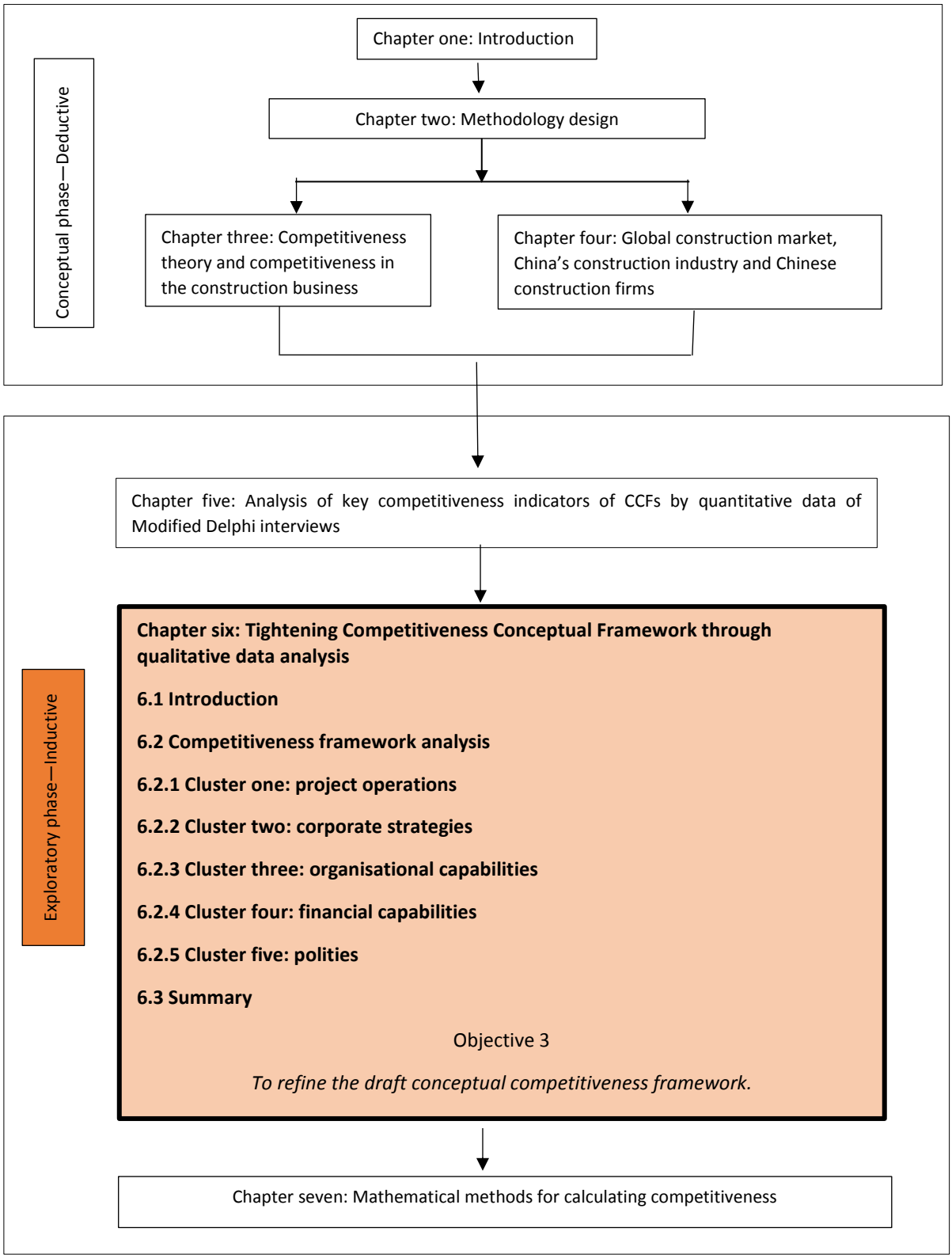
5.3 Summary

Accordingly, the aim of this chapter was to refine the importance of KCIs contribution to CCFs' success based on the quantitative interview results. Modified Delphi interviews were conducted in two rounds to investigate the importance of KCIs by ranking in the draft competitiveness framework (Figure 4.8), from which 21 KCIs emerged from the secondary literature review. In the Modified Delphi interviews, interviewees proposed additional 32 KCIs. Good consensus among all participants was achieved in the second round of interviews. However, four indicators (liability, a nation's protectionism, claims on the project, and a company's qualifications) did not achieve good agreement because their median scores were not highly rated. Thus, those four indicators must be removed from the KCIs' list, and a total 49 KCIs were to remain. Moreover, those 49 KCIs' degree of importance positions were ranked by their mean scores, the draft competitiveness framework was refined in Figure 5.1.

In the next chapter, the refining competitiveness framework (Figure 5.1) could be tightened by qualitative analysis of each of the KCI's contents based on the literature review and interviewees' answers.

Chapter Six

Tightening Competitiveness Conceptual Framework through qualitative data analysis



6.1 Introduction

From the research findings in chapter four the 21 Key Competitiveness Indicators (KCIs) emerged, which helped to establish a draft conceptual competitiveness framework (Figure 4.8) in a hierarchical structure of those KCIs. Chapter five investigated the degree of importance of the KCIs with 32 construction industry experts. A total of 53 KCIs were analysed using SPSS software, which included the 21 KCIs identified from the literature review and the 32 KCIs that were proposed by interviewees in the first round of interviews. However, a total of 49 KCIs remained, as four KCIs did not achieve consensus.

Therefore, a draft conceptual competitiveness framework was constructed (Figure 4.8) with three clusters: corporate strategies, organisational capabilities and financial capabilities could be refined by reference to those 49 KCIs. However, based on the definitions of the 49 KCIs, the competitiveness framework could be separated into five clusters: project operations, corporate strategies, organisational capabilities, financial capabilities and policy (Figure 5.1). The aims of this chapter are:

1) To understand the sense of each cluster
2) Clarification of KCIs and tightening of the refining competitiveness framework by reference to the literature review and interviews results

6.2 Competitiveness framework analysis

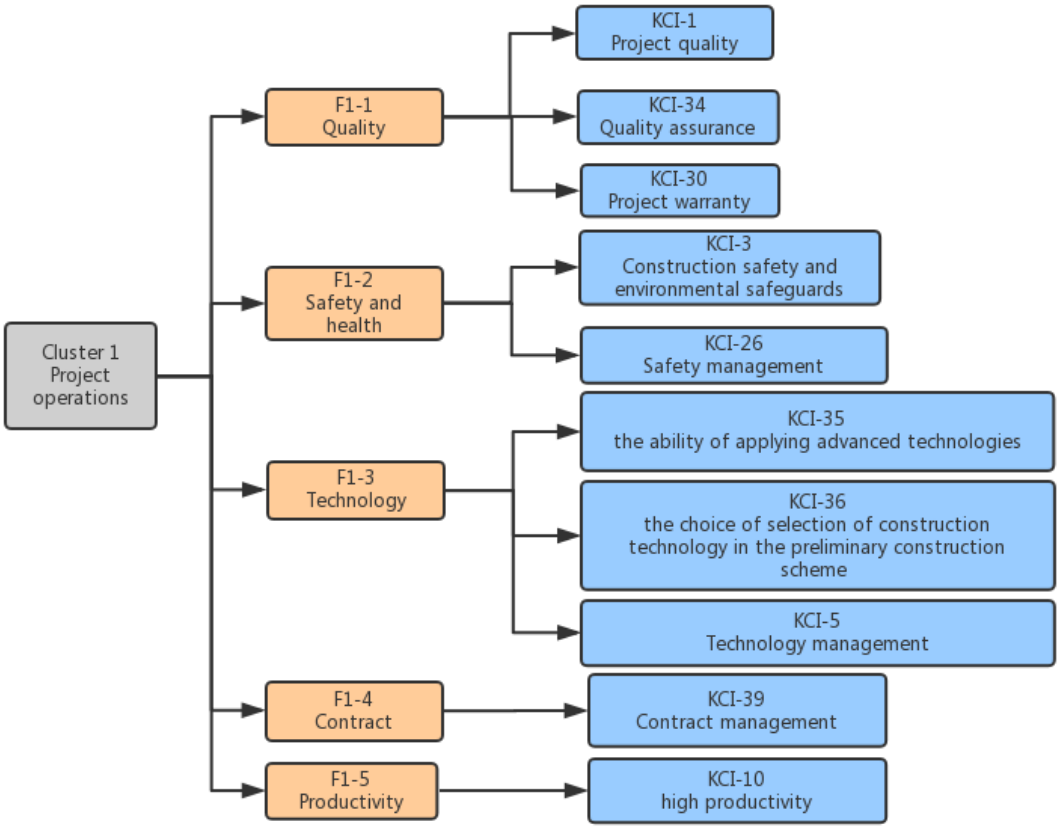
6.2.1 Cluster one: Project Operations

Porter (1980) stated that firms ultimately gained and sustained competitive advantage by successfully delivering their products or services. Gao *et al.* (2013) noted that a firm's competitiveness would be measured through its products. In reality, thought, a project such as a construction firm's product was, also, a major source of competitiveness. Therefore, it was necessary to consider a project's operation part of a construction firm's competitiveness. Lu (2006) pointed out that this was particularly true in the construction industry where a failure in a single project could cause serious loss to a contractor. Figure 5.1 illustrated that ten KCIs divided into cluster one were relevant to a project's operation, including:

KCI-1 project quality; KCI-3 construction safety and environmental safeguards; KCI-39 contract management; KCI-35 the ability to apply advanced technologies; KCI-34 quality assurance; KCI-36 the choice of selection of construction technology in the preliminary construction scheme; KCI-5 technology management; KCI-26 safety management; KCI-10 high productivity, and KCI-30 project warranty.

It can be seen that these KCIs were related to five factors (Figure 6.1): quality, safety and health, technology, contract, and productivity.

Figure 6. 1: Cluster of project operations



Source: Author (2017)

6.2.1.1 Factor of quality

Three KCIs were divided into the factor of F1-1 quality, including: KCI-1 project quality; KCI-34 quality assurance; and KCI-30 project warranty.

KCI-1 Project quality

Hart (1994) indicated that quality had a three-fold meaning in construction: it meant getting the job done on time; it meant ensuring that the basic characteristics of the final project met the required specifications; it meant getting the job done within budget. In this research, project quality meant that it met the requirements relating to standards and contracts. Consequently, Mr A and Mr H argued that project quality depended on the contract's requirements.

Mr E, manager of the overseas marketing department in T2 group, said:

> *"Without good project quality, a company will lose business in the market, a project's quality is a main factor to be considered by owners and clients. The owners want to see their project completed with good quality that abided by the contract. The clients want to see the project has good quality performance relating to a project's use, incorporating safety and lives' safety post construction".*

Similarly, Mr X, manager of project department in NT8 Corp., stated:

> *"The safety of people's lives will be affected if any quality problems happen in the project".*

An example about the significance of project quality have been revealed. A huge fire engulfed a Grenfell tower, a social housing complex of almost 1,000 homes in West London on 14th June 2017, causing at least 80 people to died and a total of 65 people were rescued from the building by firefighters (BBC 2017). Grenfell Tower was built in 1974 by Kensington and Chelsea London Borough Council and was refurbished in 2016 (Royal Borough of Kensington and Chelsea 2017). Residents expressed significant safety concerns before the fire, with criticism levelled against the council for fire safety and building maintenance failures (Mills 2017). They had also said repeatedly that their escape path was limited to a single staircase in the event of a fire (Knapton and Dixon 2017). Some residents said no fire alarms went off when the fire started and that they were alerted to the fire only by people screaming for help or by knocks on the door (ITV 2017). Fire safety experts have pointed to cladding on the building as a possible reason the blaze to spread so quickly, but the contractor responsible for the renovation of the tower, said its work met all required building controls, fire regulations, and health and safety standards (BBC 2017). However, the aluminium-polyethylene cladding failed fire safety tests conducted after the fire (Siddique 2017). This tragic example, has provided concern for a project's quality relating to people's safety. Quality should meet the requirements of construction regulations and contracts, otherwise, bad quality could result in painful loss of life.

Zantanidis and Tsiotras (1998) pointed out that the quality of both products and services has become an issue of survival, if for several reasons: the rapid development of technology, fierce international competition, the growing demands of clients and industry standards for safety and environmental protection have jeopardised safety. According to Rahman (1993), the basic purposes driving the introduction of quality in the construction industry were the following: reduction of production costs, improvement of safety, on-time completion of projects, and establishment of a healthy framework of competition.

Mr Y considered that quality could affect a project's economy and operation, he said:

> *"A Project requires repairing or rebuilding if a project's quality has any problems, it could be a waste, including financing, time, materials, and human resources".*

Mr AA, manager of project department in NT11 Corp., firmly believed that:

> *"Delivering good quality to the market is the fundamental guarantee for a construction firm's development".*

By contrast, Hart (1994) indicated that quality was necessary but difficult. Fierce competition has induced entrepreneurs, occasionally, to use cheaper and lower quality building materials or to adulterate their products in other ways.

Professor AE illustrated:

> *"Good quality comes at a price. If you want to make soup that tastes good you need to have the money to buy the meat, fish and vegetables to go in it. If you want quality, you have to spend the money to obtain it. There is also something called standards; this is too often not the top quality, building standard – the building regulation may say you have met this. But when you want a higher standard you pay. In some projects, it may well be that quality is not the top most thing, it may be health or safety, or cost. If my client said I don't have too much money, but I don't want you to do something that is bad, but if it reaches the minimum standard that is fine. Fit for purpose is fine, I don't have money to pay for exceptional quality. Thus, context is important".*

Belohlav (1993) explained that quality is seen as an operational activity, part of a system, and as something related to the culture and value of an organisation. A high level of quality was not necessarily synonymous with being successful or even making good strategy. The quality perspective provided the basis for strategic advantages. Furthermore, simply doing better would not be enough to remain competitive in the long-run, if the highest levels of quality were not achieved.

KCI-34 Quality assurance

How to control project quality was a direct question when construction firms considered their project quality. In the first round interviews, Mr P, senior engineer in NT2 Ltd. mentioned:

> *"Quality is the most important task for construction companies; all construction firms have their own conduct procedures to control project quality. However, do the Chinese companies follow these procedures? Are project assurances useful in overseas markets? Thus, it is important that CCFs have their own procedures to meet international quality*

assurance's requirements, for example, ISO 9000, in order to achieve better performance in overseas projects".

Zantanidis and Tsiotras (1998) claimed that the organisational level and the project level were two levels by which to consider the development and implementation of a quality assurance system in the construction industry. The project level sets the overall (organisation-wide) quality policy and quality system procedures, while the organisational level focuses on implementing the applicable elements of the quality system for each different project.

Ms. I, senior engineer in T2 Group, stated:

"In order to meet the international quality level, each construction enterprise should develop and improve its quality assurance, which will play an important role in the investigation, design, and construction. Additionally, it will be able to supervise and continuously improve project quality".

Zantanidis and Tsiotras (1998) noted that it was important when implementing an effective quality assurance system to be able to differentiate it from those of competitors. To achieve this, managers and quality assurance experts should try to assess an organisation's strengths and weaknesses, objectively and pragmatically, and a system of development should be based on this assessment. Russell (2012) stated that quality assurance and quality control were two aspects of quality management. While some quality assurance and quality control activities were interrelated, the two have been defined differently. Quality assurance consisted of that part of quality management focused on providing confidence that quality requirements would be fulfilled. The confidence provided by quality assurance was twofold—internally to management and externally to customers, government agencies, regulators, certifiers, and third parties. Quality control was that part of quality management focused on fulfilling quality requirements. While quality assurance related to how a process performed or how a product was made, quality control was more the inspection aspect of quality management. Lakshmi (2015) noted that quality assurance could be applied to the quality planning tools and techniques and quality audits to manage quality plans, quality results, and control measurements, in order to achieve quality improvement.

KCI-30 Project warranty

Project warranty was another important indicator of quality control from interviewees' answers. Udell and Anderson (1968) explained that with the decline of caveat emptor and the growing implementation of the marketing concept, a product warranty was becoming an increasingly important dimension of competitive strategy. The nature and extent of the warranty affected

sales, market share, costs, and profits of many businesses. Olson and Jaco (1972) noted that consumers believed that a product with a superior warranty would be associated with greater quality.

Mr D, assistant manager of the overseas marketing department in T2 Group, explained:

> *"In reality, a lot of delivering projects have poor quality problems: roof leakage, plaster becoming detached from the walls and wall cracks. However, many construction firms delay repairs or do not repair within the warranty period. This has caused customers to lose trust in construction firms. Thus, CCFs must pay attention to project warranties in overseas projects".*

Mr N, Manager of project department in T5 Group, noted:

> *"Quality warranty is the commitment of construction firms to their clients and investors. Additionally, it is a means to improve construction firms' trust and social competitiveness".*

Mr V Assistant manager of project department in NT7 Corp. stated:

> *"Project warranty is not the only responsibility which construction enterprises should undertake for their project quality, but, also, it is the construction company's social responsibility, and legal responsibility".*

As Wiener (1985) claimed that mandating the simple and understandable disclosure of a warranty's terms was the primary legislative method used to improve product reliability. Moreover, Kale *et al*. (2013) found that firms with warranties had the lowest debt levels, firms without warranties, but operating in industries where other firms offered warranties, on average, carried higher debt, and firms in industries where no firm offered a warranty had the highest debt levels. Thus, project warranties did not only contribute to project quality, but, also, enabled construction firms to lower their debts.

6.2.1.2 Factor of safety and health

Factor of F1-2 safety and health includes two KCIs: KCI-3: construction safety and environmental safeguards, and KCI-26: safety management

<u>KCI-3 Construction safety and environmental safeguards</u>

Safety was a major issue across global construction industries (Zhou *et al.* 2012). The construction sector employed approximately 7% of the world's work force, but was responsible for 30–40% of fatalities (Sunindijo and Zou 2012). The Health and Safety Executive (2015) indicated that each year in the construction sector around 3% of workers suffered from a work-related illness and injury. The impact of health and safety failings in terms of working days lost, costs to society, and

enforcement action taken against employers was significant within the sector. Kazybayeva (2016) indicated that clients were interested in the completion of projects on time, without any delay on the part of the contractor in the form of accidents to workers.

Five interviewees of T2 group boasted that construction safety and environmental safeguards were their company's aim, all the projects undertaken by T2 group were required to achieve this aim. T2 group had a code of conduct to control a project's safety and promote a healthy environment in order to achieve excellence in a project's performance.

However, Lecturer AF illustrated a case in his working experience:

> *"I worked for a British company in the sultanate of Oman – we had no safety or a healthy environment in construction: all the labourers were dark-skinned and the higher level employees were all light-skinned – on a very old site (for the Omani military) some old barrels of gunpowder were discovered and deemed by the military not to be dangerous. There was no respect to safety and health, people were smoking nearby and the resulting explosion killed about 35 people, thus safety on a construction site is very important. Additionally, in complex building projects of today, people want to know that the materials are of a quality that will not give rise to allergies or cause health problems".*

Mr U and Professor AE stated that it depended on the context; for example, the health and safety environment on African construction sites was very poor and messy. Mr C and Mr P stated that a safety and healthy environment not only affected construction workers on site, but also affected surrounding residents and the ecological environment; consequently, construction companies had a responsibility to ensure our construction projects did not endanger staff, people and the social environment. Therefore, the purpose of construction safety and environmental safeguards was to ensure that everyone enjoyed a good working and living environment (BAR 2008).

Furthermore, some interviewees considered that safety and health management were relevant to a company's image and trust.

As Ms I pointed out:

> *"Many constructions damage the environment and some Chinese companies do not pay attention to construction workers' safety on site. These dangerous operations could result in CCFs getting a bad image".*

Construction safety and environmental safeguards not only impacted on people's health and safety environment, it also contributed to construction firms' image. A poor corporate image could affect a firm's to lost trust in the market.

KCI-26 Safety management

Zhou *et al.* (2015) said that the majority of injuries have been ascribed to workers' lack of safety behaviour. It was widely recognized that workers' unsafe behaviour was intrinsically linked to workplace accidents.

Similarly, Ms I said:

> *"In my company, the project managers should educate all project workers to have safety awareness and to apply measures to protect themselves. Project managers and workers needed to sign a document after each safety training session, in order to ensure workers accepted responsibility for safety training".*

Mr K, assistant manager of project management in T2 Group, claimed:

> *"My company carries out safety responsibility systems, a project manager must ensure staff and a project's safety according to the company's safety regulations. A project manager will be held responsible if his project has safety problems. All projects must have safety officers who check a project's safety daily and submit safety reports to a project manager weekly. A project manager will order workers or subcontractors to overhaul a project if any safety issues happen".*

Mr T, manager of the project management department in NT6 Ltd. believed:

> *"Different working customs and language barriers between Chinese and local staff, cause many safety issues to occur. Thus, it is important to enhance safety management in international projects, especially, to ensure on site staff understand safety requirements and improve their safety operational skills".*

Senior Lecture AC said:

> *"Safety is the basis of a project's operation. Safety management throughout the whole construction process is an important branch in project management. If a project does not have excellent safety control, it will damage the enterprise's reputation, discredit enterprise's image and harm workers' safety".*

Furthermore, Ms W, Assistant manager of marketing department in NT7 Corp. clarified the position:

> *"When comparing overseas and domestic projects, there are many differences, such as, the social environment, political issues, local laws, cultural customs, and geography concerning these differences. Domestic safety management systems, in terms of feasibility*

and effectiveness, will be restricted. If serious safety accidents occur in overseas projects the Foreign Office might be involved. Thus, in order to reduce safety hazards in international projects, Chinese construction companies should establish a high level and a feasible safety management system, which has attained international safety management requirements".

However, Senior lecturer AF considered:

"I have worked in construction. Yes, everybody is given a hard hat. But does it influence corporate success? No. This does not determine the global success of a CCF. What will determine that is the cost of the project. Safety might be something which is presented as 'important', but I think it is more part of the image being projected rather than being truly important".

Howes and Tah (2003) suggested that the construction company must comply fully with local safety legislation. It was the responsibility of the project manager to adopt and implement safer systems of work. This effectively meant that construction methods to be adopted should not place workers in danger. A safe site would encourage good morale and a sense of well-being which should be reflected in increased productivity, that would more than offset the cost of health and safety provision.

6.2.1.3 Factor of technology

Three KCIs might be considered to relate to the factor of technology, including: KCI-35 the ability to apply advanced technologies; KCI-36 the choice of selection of construction technology in the preliminary construction scheme; and KCI-5 technology management.

<u>KCI-35 The ability to apply advanced technologies</u>

Some interviewees considered that in a project's operation, staff had the ability to apply advanced technologies in a project was important. Because technological application was constantly changing with the development of new technology, it was important that staff had the ability to accept new technologies and to apply them. Pei (2006) stated that labour was the most important factor in productivity, productive forces could not achieve anything without labour. Therefore, a construction team's employees as labour in projects, must have the ability to apply advanced technology. As Mr G, senior engineer in T2 Group, said:

"Advanced technologies are widely used in large international projects, new processes, new materials and new equipment, which require companies to have a group of high-tech experts, managers and skilled workers to operate them".

Ms AB and Mr R noted that the ability of applying technology directly affects the project's quality, thereby improving the enterprise's competitiveness and promoting technological innovation.

Mr O, manager of the overseas engineering department in NT1 Group, said:

> *"The ability of applying advanced technology occupies a very important position in the whole construction process. Cultivating construction workers' technical ability encourages the utilization of new technologies and new equipment which will improve labour productivity, resulting in safety on the construction site and ensure project quality".*

Workers had the ability to use advanced technology, it was fundamental for the use of technology to be utilised, but, also, it should ensure that advanced technology could contribute to sustainable development in the future (Li 2000).

KCI-36 The choice of selection of construction technology in the preliminary construction scheme

Zhou *et al.* (2013) stated that a technological application scheme could be deemed an effective way to further construction management. Many interviewees considered that it was important to formulate a construction scheme based on current construction technology. Mr N noted:

> *"How to apply technologies in a project or what technologies could be utilized in a project is the primary issue required to be considered in project management".*

Mr K explained:

> *"The construction scheme is the concrete analysis of construction methods throughout the whole project. It comprises specialized technologies and an economic analysis of the whole project's implementation, including: materials, labour, costs, machinery and equipment, and the project's duration. Therefore, based on construction technology, plans to design a construction scheme, which enables a construction team to select the best construction programme is essential".*

Mr AA said:

> *"A construction scheme directly impacts on the project's programme, so it is important to have a reasonable and high-tech programme to design the construction scheme".*

KCI-5 Technology management

Gao *et al.* (2013) noted that the one of internal factors determinants of a firm's competitiveness was technology. A firm's competitiveness was significantly affected by its technological capacity.

Mr Z, manager of the project department in NT10 Group noted:

> *"Technology management throughout each stage of a project programme, is an important part of project management, it directly impacts on construction management".*

Mr O commented:

> *"Technology management has two aspects, one is innovative involving new technologies, and the other one is to develop existing technologies, to ensure the application of suitable technologies in the construction process".*

All 28 interviewees from construction firms considered technology management contributed to outstanding project performance: excellent quality, time-effectiveness, safety, and cost-effectiveness, leading to an improvement in a construction team's productivity. Consequently, technological management determined business efficiency, corporate reputation and company survival. Construction firms must possess certain technical conditions and technical equipment, and those technical conditions and technical equipment required good technology management to control them. Many construction enterprises could lose out to competition despite having strong technical strength, because of their weak technological management (Zhai 2011).

6.2.1.4 Factor of contract

KCI-39 Contract management

Only KCI-39 contract management has been employed to consider the factor of contract in this cluster. Earlier, contract management was defined as the process, which ensured that all parties to a contract fully met their obligations, in order to satisfy the operational objectives of the contract and the strategic business goals of the customers (John and Arjan 2013). Le *et al.* (2013) indicated that contract management was a key component in construction management.

Similarly, interviewee Mr L, assistant manager of project management in T1 Corp. stated:

> *"Contract management is the core of overseas project management".*

Rajendran *et al.* (2013) noted that contracts were essential to the construction process. In its simplest of terms, a contract was an agreement between two or more parties that was enforceable by law. John and Arjan (2013) mentioned that a contract was a vehicle designed to serve and facilitate collaboration between parties involved. A contract could be aimed at meeting the project objectives and meeting business objectives and strategic goals of the final customer.

Mr V explained:

> *"The daily affairs in overseas projects are more tedious than in domestic projects. It requires efficiency to coordinate relationships between the different sectors, such as, owners, supervisory, and subcontractor teams. Thus, the contract needs to be strengthened to aid institutional and systematic management. Communication between the owner, supervisors and subcontractors should be carried out in the form of a written document as one part of contract management".*

Mr T pointed out:

> *"Scientific and systematic contract management are very important in overseas projects. It could provide evidence for claim or counterclaim problems in the future".*

But Mr Q, assistant manager in the marketing department in NT3 Ltd. considered that overseas contract management was a complex task. He mentioned:

> *"It effectively prevents, and controls risk in quality, cost and time, and reduces financial loss in the process of contract execution. But it requires a contractor's marketing staff to understand well the local market, the technology, and the political and economic situation."*

As Rajendran *et al*. (2013) stated that contract disputes could be associated with any or all of four major aspects of a construction project: cost, quality, schedule and safety.

Overall, just as Mr AA claimed:

> *"Contract management is very important for a project's cost control and management; it is the main measure to achieve cost effectiveness. Through strengthening contract management, an enterprise could safeguard its legitimate rights and interests, ensure positive investment benefit from projects, and improve an enterprise's economic benefit. And, consequently, improve an enterprise's brand and image, and achieve sustainable development".*

6.2.1.5 Factor of productivity

KCI-10 High productivity

Nasir *et al.* (2014) pointed out that about 8% of the total US workforces were directly employed in the construction industry; therefore, the productivity of a major sector, such as construction in a national economy was of great importance for economic growth. Labour productivity has been defined as the ratio between completed work and expended work hours to execute a project. The

presence of labour with high productivity at each stage of a project's development played a significant role in a project's success (Nasirzadeh and Nojedehi 2013).

Many interviewees considered that high productivity demonstrated a team's construction capability and contributed to a project's performance: quality, costs, and time. Mr T noted:

> *"It is good for the construction team to finish projects within a short construction time, and with very good project quality performance".*

Mr U, Assistant manager of technology department in NT7 Corp., said:

> *"It is important to measure a company's output capability, as it helps to finish more work with lower costs in a shorter unit of time".*

Hwang and Liu (2010) noted that productivity estimates were an essential element in estimating the duration and cost of a construction operation. Improving construction productivity could go some way towards eliminating time and cost overruns (Kaming *et al.* 1998).

Moreover, Mr O pointed out:

> *"This is the main index required to be considered in the bidding phase, it relates to the project schedule and project management plans".*

However, two interviewees considered high productivity was of neutral importance in firms' competition. Mr B and Lecturer AC pointed out that a construction team's productivity depended on the project context, for example, project management, project plans, construction workers' professional knowledge, and working motivation were essential considerations. Conversely, the author considered that a construction team's high productivity could assist a company's completion of a project in a shorter time with excellent performance; thus, it was good to maintain a competitive advantage at project level.

6.2.2 Cluster two: Corporate strategies

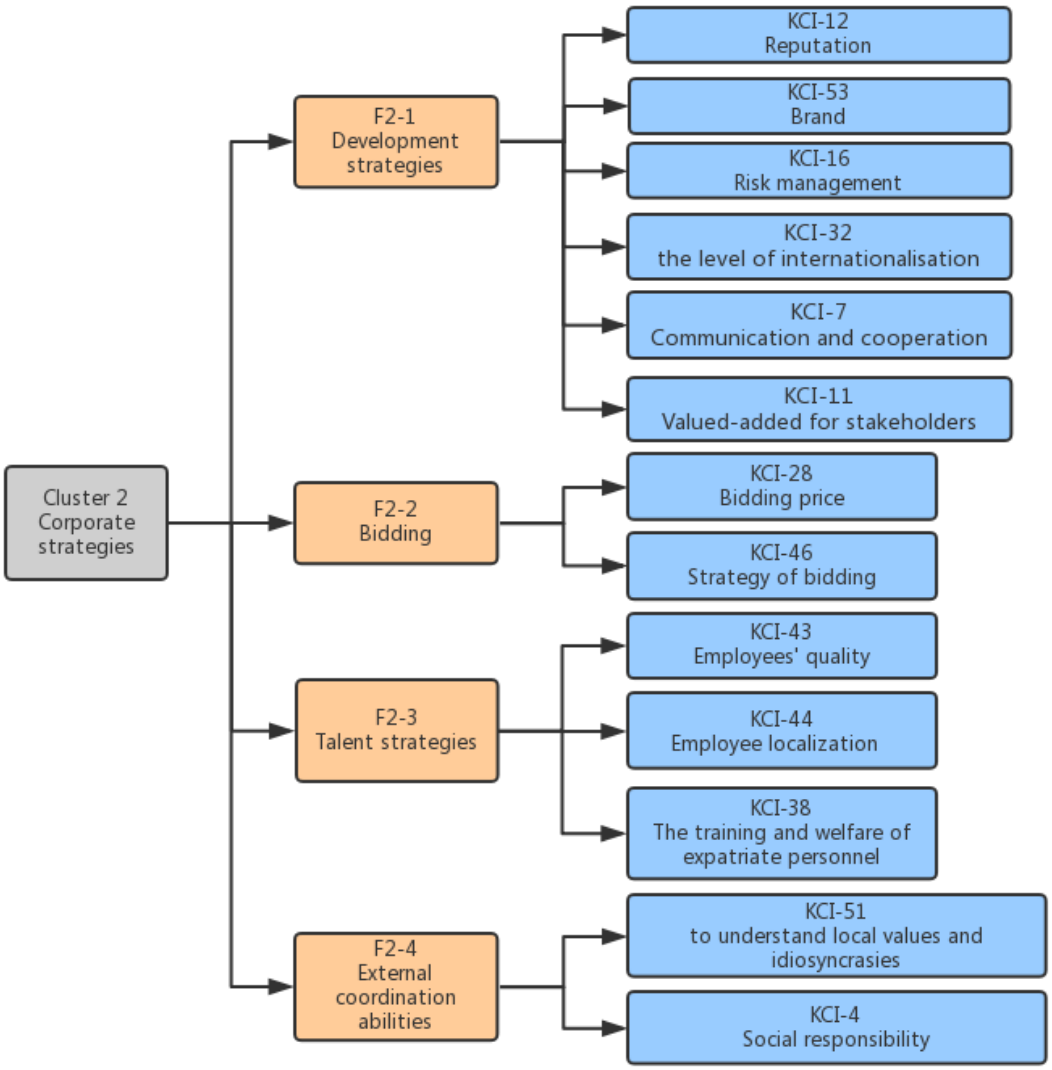
The purpose of corporate strategies was to solve the issues of corporate development in order to achieve rapid, healthy and sustainable long-term development. Xiao (2016) pointed out that an enterprise must consider its corporate strategies with respect to two points: 1) what was the future development for an enterprise; and 2) what kind of action could support an enterprise's sustainable development?

From the interviews results, 13 KCIs fell into this corporate strategies cluster: KCI-12 reputation, KCI-53 brand, KCI-28 bidding price, KCI-46 the strategy of bidding, KCI-43 employees' quality, KCI-16 risk management, KCI-32 the level of internationalisation, KCI-7 communication and cooperation, KCI-51 understanding local values and idiosyncrasies, KCI-44 employee localisation,

KCI-38 the training and welfare of expatriate personnel, KCI-11 valued-added for stakeholders, and KCI-4 social responsibility.

The author divided those KCIs into four factors (Figure 6.2): development strategies, bidding strategies, talent strategies and the ability to coordinate external factors.

Figure 6. 2: Cluster of corporate strategies



Source: Author (2017)

6.2.2.1 Factor of development strategies

Seven KCIs were divided into a factor comprising development strategies: KCI-12 reputation, KCI-53 brand, KCI-17 research and development, KCI-16 risk management, KCI-32 the level of

Internationalisation, KCI-7 communication and cooperation and KCI-11 value-added for stakeholders.

KCI-12 Reputation

Gerard *et al* (2016) defined reputation as beliefs or perceptions held about the quality of a focal actor. In a firm, corporate reputation had intangible value for organisations, and was the most important strategic and long-term organisational asset. Corporate reputation provided opportunities for organisations to develop and retain market share, influencing opinion of customers and other stakeholder groups (Sontaite-petkeviciene 2014).

The interview results showed that participants from the top 100 CCFs paid more attention to corporate reputation than the non-top 100 firms. All interviewees from the T2 group said that positive reputation was very important for their company's entry into the African market, because the African client would recognise their company.

Mr H senior engineer in T3 Corp. illustrated this:

> *"The Chinese operate a lot of projects in Africa, not only has the Chinese government a good relationship with Africans, but also CCFs have good reputation in Africa. African clients trust us".*

In addition, Mr T said:

> *"It is not only a prominent company that achieves trust in the market, but that company's staff also improve their working motivation, because staff would feel honoured to work in a famous company".*

Ms AB noted that good reputation improved a company's standing against competitors' slander and vicious competition. Overall, most participants considered that reputation was one symbol of a company's high standing in the market: with trust, image, local people's understanding and credit; also, it was one of indexes for investors to consider at the bidding stage.

KCI-53 Brand

Strong brands were considered important to the sustainability of business in both domestic and international markets (Ailawadi and Keller 2004; Mitchell *et al*. 2013). Mr R noted that brand was an enterprise's soul.

Mr L stated:

> *"Brand constitutes the main competition between enterprises. Enterprises' aim is for their products to gain a reputation as a famous brand in the market".*

Page and Herr (2002) explained that strong brands also could reduce the possible damaging effects of negative product information. If a strong brand was associated with a poorly functioning product or service, the equity of a strong brand might mitigate consumers' responses to a product's less-than-desired characteristics or performance. On the other hand, if a weak brand was associated with poorly functioning products, the lower equity of the weak brand might serve to validate consumers' judgments.

Firms relied on strong brands to gain competitive advantage and fuel growth. Consumers often must make difficult choices in situations where they lacked the ability to confidently judge product quality. Brands provided consumers with means to reduce risk and fulfil their expectations, an especially valuable function with new products. Given the importance of positive consumer evaluations of new product introductions, the ability of brands to influence consumer choice and trial was critical (Brexendorf *et al.* 2015).

Just as Mr C noted:

> *"CCFs' brands have become established since CCFs undertook overseas projects in some developing countries fifty years ago. Currently, these developing countries' clients trust CCFs, they believe that CCFs can operate their projects very well".*

Moreover, corporate brands are relevant to corporate culture, as Ms W said:

> *"Brand reflects the corporate culture, a brand is not only a symbol in the market, but also it is an internal force for employees and organisational management".*

KCI-32 The level of Internationalisation

The process of the firm's internationalisation has been widely researched over the past four decades (Korsakiene 2013). However, currently, there was no unified standard to analyse the level of internationalisation of enterprises. The main methods to determine a company's internationalisation were: the proportion of overseas assets and total assets, the proportion of overseas revenue to total revenue, and the proportion of overseas staff as opposed to total staff. At present, the ratio of overseas revenue to total revenue has been widely accepted as a measure of the internationalisation of construction enterprises. It believed that international revenue was the most significant indicator of internationalisation (Wang *et al.* 2010).

In the first round of interviews, respondent Mr N mentioned the degree of internationalisation referred to the proportion of overseas revenue against total revenue. However, in the second round of interviews, other interviewees believed that internationalisation did not just refer to international revenue, it should include the level of localisation, international management models, and operational methods.

The definition provided by Welch and Loustarinen (1998) implied that internationalisation was the process of increasing involvement in international operations. Petersen *et al*. (2001) explained that a firm's internationalisation was a result of the globalisation of industries. Hence, domestic firms could be subject to an increased pressure to internationalise rapidly in order to respond to the actions from global competitors. Domestic firms have been driven into the internationalisation process even though they lacked knowledge about international ventures and markets (Korsakiene 2013).

Mr F, manager of a marketing development department in T2 Group, explained:

> *"Before the 1980s, a large number of Chinese construction enterprises undertook infrastructure construction in the overseas market. But many of those construction companies, transferred poor domestic competition practices to the overseas market, such as ignoring quality, vicious price competitiveness, dishonesty, and did not perform their undertakings in accordance with the contract. These companies caused CCFs to have a negative image. Therefore, it was very important to improve enterprises' internationalisation practices. It has been determined that enterprises must demonstrate international responsibility, such as integrity and compliance with the rules of the international market, followed by the internationalisation of a business operation. By doing so enterprises could build credibility and brand recognition in the global market".*

Ms J, assistant manager of the marketing department in T4 Group, said:

> *"China's resource advantage is in the huge domestic market, and in the abundance of financial capital. However, with respect to global resources, including natural resources, brand, technology and management capacity, if Chinese enterprises can integrate Chinese and global resources, we will get a win-win business co-operation in the global market".*

The development of long-lasting relationships with suppliers and customers was seen as another success factor of firms' internationalisation, such relationships acting as a bridge to foreign markets and would correspond to a network approach towards internationalisation (Johanson and Mattsson 1993).

Mr N illustrated his company's market strategy regarding internationalisation:

> *"Our group's market strategy is stability in Africa, consolidation in Central Asia, highlighting the Middle East, expand*ing *the Americas, and seeking entry into Russia. In order to develop this global market strategy, we must improve our group's internationalisation management. First, we must continue to cooperate with international enterprises, in order to undertake overseas projects. Second, we should improve the*

integration of global resources in the overseas market, for example, to establish a global supply chain with 1,200 suppliers by setting up two support centres, four training centres and three joint ventures".

KCI-7 Communication and cooperation

Competition in both nations and firms has been intensified by the globalisation of science, technology, and economics; thus, many countries and firms seek global opportunities and partners in order to promote their development. Yang (2014) stated that communications and cooperation in international enterprises was a feasible pathway to achieve a win-win situation. Because partners could share their innovative technologies, advanced management methods and reduce operational risks through communication and co-operation would benefit both parties.

Several respondents considered seeking partners through communication and cooperation to enable CCFs enter overseas markets. Communication and cooperation with foreign companies encouraged CCFs to learn more advanced knowledge and to understand different management models in foreign companies. Mr R said:

"*Partners can combine their respective advantages to explore more businesses*".

Exactly as Lecturer AD said:

"It could realise resource sharing with all partners and thus improve competitiveness".

Mr D and Mr F noted that if CCFs wanted to occupy a market share in a new market, it would be better to communicate and cooperate with local construction firms or academic institutions, which could help CCFs reduce operational risks in new markets. Mr Q explained:

"A company could explore more business through cooperation with other companies, especially, in the new market, we do not know the new market well, so we should need to communicate and cooperate with other companies or experts, in order to understand the new market and to collect market information, otherwise, how we could compete with local companies".

Ms I and Mr M noted that cooperation with some companies which owned advanced technology would help CCFs by saving time and capital in order to innovate. Just as Ms AB noted:

"Communication and cooperation are important for our construction company to enter an overseas market. Our company sends managers aboard annually to communicate with international construction firms, in order to learn some different skills and seek more business cooperation. Moreover, it is important to cooperate with some academic

technology centres, because we can buy their technology, to enable us to reduce the risks by employing innovative technology".

Nevertheless, Liu (2012) illustrated that cooperation could effectively control the risk of overseas expansion. Construction enterprises must strengthen cooperation with international firms, agencies and institutions, in order to diminish the barriers for overseas expansion and to gain more access to target markets. Also, construction enterprises must reinforce communication with the local government departments, in order to understand local laws, regulations, religion and culture, in order to actively recruit local staff and promote the localisation of enterprises.

Professor AE explained:

"The context of communication is important. Above all, it is key. Because, whether it is the Chinese communicating with local workers to understand their culture, idiosyncrasies, and jokes, it is essential. It is also important that whatever makes the Chinese company communicate, top-down, laterally, or across borders – it all affects their decision making, their ability to manage risks and to coordinate and to understand social contexts. So whatever way you look at it, communication is absolutely important. If they are not naturally good at communicating, they must learn or else they will not survive".

Mr T noted:

"I think communication and cooperation are important, but not only to communicate with other companies. The most important thing we need is to communicate with local people and local staff. My experience in Malawi, was that it is difficult to communicate with local staff, because they do not understand our company's management methods and values. So sometimes local staff cannot work effectively, and the Chinese construction team cannot cooperate well with local staff, from supervisors to developers".

Morgan and Hunter (1994) suggested that communication was a prerequisite for trust. Ball *et al.* (2004) stated that good communication should affect all aspects of the customer's relationship, including trust, satisfaction and loyalty. Customer relationship management promotes building enterprises' competitiveness through understanding customer demands, improving product, and service branding and customer allegiance, and collecting, and effectively using information to achieve a more holistic view of the customer (Sammut 2011). Thus, communication was very important for a firms' competitiveness, which related to a good relationship with partners, governments, staff, and customers.

KCI-11 Value-added for stakeholders

Value creation was also a major objective of companies' performance. It aimed at meeting the general interests of stakeholders (Vasile 2013). Effective management of the relationship between a company and its stakeholders has becomes one of the key factors for the company's success (Guan *et al.* 2009).

However, several interviewees considered value-added for stakeholders to be a vague idea in CCFs. As Mr L said:

> *"Value is a fuzzy idea, different stakeholders, investors and clients have different values, we cannot meet all the values for them, so construction companies need to consider what value can be understood and met for stakeholders".*

Mr B doubted:

> *"What is value? What kinds of value? Who are the stakeholders?"*

However, Mr E noted:

> *"If you ask a Chinese person what value you want to achieve from a construction company, perhaps he could not answer you in detail; if you ask this question to a Chinese shareholder, perhaps, he would answer that he wants to gain a positive dividend every month. Value is a complicated concept, we are not only adding more dividends for our shareholders, we also deliver other values for our stakeholders, for example, project safety, sustainable environment, education funds, and staff welfare. Possibly it is not a clear idea in the Chinese construction market, but it is important in the global market".*

Professor AE described:

> *"Value-added is very important, it is a measure of quality and safety; if the level of incidents concerning safety is low and a healthy environment is high, where passers-by are safe then value is added; but, construction companies need to understand what value is*".

Though, many respondents considered that value-added for stakeholders was important. It contributed to a company's image, trust and reputation. Mr X pointed out:

> "*It is very important for our company; our company's aim is to create value with clients together*".

Mr F and Mr N considered that it was an important responsibility for a company, it required a company to consider all the stakeholders' benefits, not only shareholders' benefit. Mr F said:

> "*A company should not only focus on the financial performance for shareholders, a project could contribute to many stakeholders, which includes a company's staff, investors, sub-contractors, clients, and residents. Thus, it is crucial to consider these stakeholders' value when undertaking a project*".

Mr X considered:

> *"Value could be divided into many sectors. A shareholder is one of the stakeholders. Many companies take account of shareholders' profit value. However, the case of Wanke Group's share issue allows me to consider that a company should not only think about shareholders' benefit. When Wanke dealt its shares with the Baoneng Group and the Hengda Group, they only considered their major shareholders' benefits, rather than its stakeholders. The small investors who took Wanke's shares were worried about the decreased dividend, and the staff in Wanke felt confused, because they did not know who would be their main boss. So company considered value for different stakeholders was important, not only concentrating on shareholders".*

Mr W said:

> *"As staff in the marketing department, we are not only looking at what benefit we can gain from the market, we also look at what value we can provide for our clients, otherwise, clients will not trust and will not support us".*

As a Stanford memo (1963) stated, those groups without stakeholders who supported the organisation would cease to exist (cited by Freeman and Reed 1983).

6.2.2.2 Factor concerning Bidding

Competitive bidding has played a key role in the construction business. Winning projects was essential for contractors to survive in the current market and in the future (Lu 2006). Based on the interviews results, two KCIs included the factor of bidding: KCI-28 bidding price and KCI-46 the strategy of bidding. Mr R said:

> "*The aim of bidding for overseas projects is to increase the corporate internationalisation level and to expand more in to the international markets*".

<u>KCI-28 Bidding price</u>

Tan (2014) noted that bidding price was directly related to the success or failure of a project's undertaking. Many interviewees considered that bidding price was the most important indicator in the bidding phase, a competitive bidding price would attract investors' interest.

Mr D stated:

> *"Bidding price is the basis for winning a project. A reasonable bidding price could determine the success of domestic construction enterprises to participate in overseas projects".*

In China, bidding prices for a project were calculated from quantities of work based on norms and quotas, which were yardsticks for labour, material and plant consumption (Lu 2006). However, a norms and quota system could not be applied to overseas projects.

Some participants described the reasons for the importance of bidding price in international projects. For instance, Ms J thought:

> *"In the domestic tender process, most construction firms were allocated projects according to the quota, which was issued by the state or by a construction enterprise. Thus, in the process for bidding price calculations, firms only needed to refer to the quota to calculate the project price. However, the domestic quota method was not useful for overseas projects. The bidding price for international projects required marketing staff to research local actual conditions, for example: local labour salaries and local labour law regulations, preferential tax policies, local economic levels and project requirements before making a bid".*

Mr Q reiterated:

> *"My company hires a professional accounting firm to participate in the bidding process, in order to reasonably analyse the local market for a bidding quotation. Because construction enterprises must take into account a project's cost, quality and time before signing contracts, once the contract has been signed, the project must be completed to abide by the contract requirements, even if we lose money. Therefore, the bidding price is very important".*

Friedman (1956) and Sun (2013) indicated that the optimum bidding price was the one that resulted in maximum expected profit. Traditionally, bidding price was mainly used for assessing construction firms' competitiveness (Shen *et al.* 2004). However, there was a weakness where only a bidding price was used for selecting contractors, such as poor quality and prolonged construction duration (Drew and Skitmore 1997; Cheng *et al.* 2000).

KCI-46 The strategy of bidding

Skitmore (1989) indicated that competitive bidding in construction was therefore concerned with contractors making strategic decisions in respect of: 1) project selection whether or not to bid for

a job; and 2) determination of a bid price if a contractor's option was to bid. Therefore, the strategy of bidding was significant for construction firms to manage their bidding activities. Bidding strategy in construction has been defined as a skill of management to organize all available resources, including physical and financial, in order to consider various aspects, such as: internal, external and environmental, with the intention to win against competition, and achieve maximum project performance (Wibowo *et al.* 2015; Astana *et al.* 2015). Research was conducted by Lu *et al.* (2008) in Mainland China, it identified 35 factors influencing contractor competitiveness. Through an analysis of success factors for contractor competitiveness, bidding strategy was the most important factor.

Mr E said:

> *"A tender offer is an important part in the bidding process, especially in an international project; because a lot of global construction firms participate in a project's bidding. Therefore, a reasonable strategy for bidding could improve CCFs' competition with rivals".*

Ms J explained:

> *"The strategy of bidding affects bidding prices. For example, if the project has a long construction period, normally, it may adopt a low price strategy with low profit margins; if the project is over a short construction period, it may adopt a strategy involving a higher offer, in order to reduce uncertainty risks in the market".*

Further, Mr D stated:

> *"International projects involve larger scale projects, not only involving a more considerable capital chain, but might also be related to national relationships. Thus, bidding staff must understand the importance of a tender, and develop correct bidding strategies that abide by the regulations of fair competition".*

In the construction industry, competitive bidding has been used for a variety of procurement routes available for satisfying investors' construction needs. While investors would naturally aim to strike the best bargain by maximizing competitive intensity, contractors would ideally submit a bid offer that was likely to provide the best pay-off, allowing for the costs and potential risks of an undertaking in particular project (OO *et al*. 2010). Lu (2006) considered that some problems relating to an avoidance of tendering, excessive subcontracting, and unfairness or corruption still existed in bidding. Thus, it became necessary to formulate bidding strategies in order to avoid these problems in the global construction market.

6.2.2.3 Factor of talent strategies

The 21st century could be considered a century of knowledge-based skills in which dominates economic development was dominant. In such a knowledge based economic society, talent has become the most important resource (Zhao 1999). According to the interviews results, three KCIs were divided into a factor that considered talent strategies: KCI-43 employees' quality, KCI-44 employee localisation and KCI-38 the training and welfare of expatriate personnel.

KCI-43 Employees' quality

Competition between enterprises was actually a talent competition. Enterprises that had strong, high-quality employees could achieve effective management and technological innovation. It could be said that the quality of employees was the core competitiveness of an enterprise (Qin 2011). Xu (2007) indicated that the success or failure of a business not only depended on whether a manager's making-decision was correct or not, but it also depended on the quality of an enterprise's employees. The quality of employees could directly affect the development of enterprises. Furthermore, it was related to a Chinese enterprise's survival and development in the highly competitive global market.

Mr A, assistant Manager of a project management department in T1 Corp. said:

> *"The quality of employees determines a company's success or not. Recruiting and cultivating international talents is the most crucial task if CCFs want to develop in the international market. The expatriates in my company should possess good morality, a healthy body and a positive working attitude".*

Mr Q explained:

> *"Different languages, cultures, customs, religions, and living environments pose challenges. Therefore, from expatriates a higher quality is demanded than from domestic employees. If unsuitable staffs are sent to an overseas project, this could cause the project economic losses, and poor political and social influences. The good quality of employees is key for CCFs' success in operating international projects and expanding in to the global market".*

KCI-16 Risk management

Howes and Tah (2003) stated that risk assessment was a vital component in the determination of an international corporate business strategy. Risk management was fundamental to undertake business or project objectives, and it should be employed not only by trying to avoid poor results, but should also act as a guide to maximize positive results (Zou *et al.* 2010). Lecturer AD noted

that risk management enabled a firm to maintain an operation's stability of both the company and the project. Senior Lecturer AF indicated:

> *"If you manage risk badly you will make mistakes that will impact on your reputation".*

Mr O stated:

> *"Construction involves high risks, but high rewards in business; many risks could happen during pre-construction, construction and in the delivery of projects, for example, political risks, staff safety risks, material delivery risks, and breaches of contract risk. Thus, risk management is important for construction firms, whether in the international market or in the domestic market".*

Risk management has been viewed as a positive and proactive process intended to reduce the likelihood of unsatisfactory consequences for the project at different stages, such as design, construction and operation (Rohaninejad and Bagherpour 2013). Consequently, risk management is considered a vital tool in the management of projects and was becoming an essential part of the decision making process (Choudhry and Iqbal 2013).

Mr T maintained:

> *"Effective risk management could allow a company understand the risks which happen in overseas projects, and induce a company to take measures to avoid or reduce risks and loss. Furthermore, it is necessary for a company to obtain compensation when risks have become realised for some reason, in order to ensure a project's continuation, and for business's operational activities to ensure an enterprise's survival".*

Just as Serpell *et al.* (2015) demonstrated, risk management was an important area of project management, since it allowed anticipating the occurrence of events that could adversely affect a construction project, and to define actions that could minimize their impact.

Mr D said:

> *"Every project has risks, risk in political instability, risk in bad weather affecting a project's progress and risk to staff's safety. Many risks could happen in an international business, we cannot avoid all the risks, but we can predict risks and solve risks. Before we undertake or invest in projects, we must analysis the risks in the market and then draft a risk report in the bidding phase, in order to control risks and negotiate with developers and subcontractors, because risk affects our profits, sometimes, if we do not solve risk very well, it could affect company's image, people could think that we lacked the capability to undertake projects".*

Besides, risk management involved staff's security abroad. Mr C and Mr K stated that political environment risks could cause a project to shut down, and threaten personal safety in some unstable countries.

Mr M assistant manager of project management in T2 Group noted:

> *"Some staff do not want to work overseas because they consider developing countries unsafe, and a threat to their lives. So risk management is important when undertaking overseas projects".*

Howes and Tah (2003) pointed out that political risk was one of the most difficult areas to anticipate and predict. Political instability was normally associated with third world and developing countries that were undergoing momentous changes, major political risks could, at worst, involve the expropriation of company assets without compensation, or could involve trade sanctions.

Mr U referred to Hinkley Point C nuclear power station as a case to indicate the CCFs lack of ability to manage political risks:

> *"I think many Chinese construction firms lack risk management ability. Most of them solve risks based on their experience, and lack normative and scientific management methods. For example, an absence of a risk information system that could monitor and analyse risks in the market before bidding for a project would be a serious oversight. Thus, if a project's feasibility analysis is not comprehensive, when the risks are realised during the construction period, we cannot respond quickly and correctly. Look at the Hinkley Point C, when the UK attempted to prevent China General Nuclear group to participate in its construction. What did China General Nuclear group do? Nothing, mainly based on the Chinese government's ability to deal with the UK government, although it is a project based on contracts between countries, it can be seen that a Chinese construction company lacked a risk assessment".*

In addition, it was significant that CCFs understood risk management standards, for example, ISO 31000, which was the international standard for risk management; it provided the principles and practices for general risk management that could be employed for organisations; it encourages enterprises to identify risks, analyse risk treatment options, to select the best response, to implement risk mitigation and controls, and to monitor results and revise as necessary (Lark 2009). Understanding risk management standards was one part of CCFs' corporate knowledge for developing global business by avoiding risks.

KCI-44 Employee localisation

Many interviewees considered that it was not enough for CCFs to send good quality expatriates to overseas projects. CCFs were required to consider employing local labour, and the primary step of localisation was local employee recruitment. Because an international project was often not an independent subject of action, it covered, also, cooperation between host countries and countries undertaking a project, so recruiting local employees was a necessary consideration both for the project's cost-effectiveness and political communication with host countries (Li and Li 2014).

Mr H considered:

> *"My company's infrastructure projects were in Kenya, we recruited local employees more than 90% of the total number. At present, my company reserves 40% of contract prices to pay local staff's salaries in every overseas infrastructure construction project".*

Wang (2006) noted that multinational companies needed to employ staff locally to establish a positive image in the local market, and to adapt to the host country's relevant policies and maintain stability in an overseas business.

Mr D noted:

> *"Recruiting local employees facilitates CCFs' integration into local society, and more quickly enter the project country's market. However, how to effectively manage foreign workers is a significant factor for CCFs".*

Some interviewees considered employee localisation good for achieving lower operational costs. Mr Q said:

> *"CCFs normally build up a construction team in China first, and then send the construction team to undertake overseas projects. However, with the increasing costs of expatriates, hiring local employees makes it possible to reduce employee costs".*

As Selmer (2003) stated, it has been noted that local staff most probably reduced total compensation costs since expatriate compensation was normally higher than compensation to local employees.

Mr S revealed:

> *"International projects are not only an individual business operation, but also it is the cooperation and communication between two countries. Therefore, hiring local staff is not only for making costs more reasonable, but it serves also to benefit local social and*

economic development. As such, it could assist in solving local employment pressure; enhance local engineering and increase the technical skills of personnel, and, by doing so, improve staff quality, moreover, it will promote communication and coordination in business management and culture".

Mr T described:

"Expatriates are not familiar with the local language, thus, a company must hire local translators. However, if the translator does not understand the project sufficiently well, it may cause misunderstanding in communication between Chinese managers with local staff. If, by hiring local employees, it helps a company to understand local laws, business rules and customs, it may facilitate a company's communication with local people; and assist a company in managing local staff when hiring local personnel as project managers".

Selmer (2003) explained that because of different language and cultural barriers, it would be easier for local employees to exploit and interact within the crucially important intricate network of personal and business contacts. Expatriates might be able to develop good contacts at senior levels, but local managers would probably be more suitable to build critical relationships among lower levels of a company, and government hierarchies. China International Contractors Association (2016) analysed the employees' localisation in China Civil Engineering Construction Corporation (CCECC) Nigeria Ltd. as a case. By 2012, CCECC Nigeria Ltd. had nearly 13,000 local employees, contributing a great deal to social stability and economic development in Nigeria, but the technical and educational levels of local African workers were relatively low. With the expansion of CCFs' business, enhancing local staff's quality and increasing the localised management of employees had become practical problems facing CCFs. Thus, local workers must be instructed and trained with regard to quality management by local senior employees in charge of recruitment before taking up their posts. In Nigeria, CCECC has developed an entirely localised management team capable of conducting measurements, management, consultation and reporting. While improving local labour quality, it has also gained a backbone of staff committed to the long-term development of the company.

<u>KCI-38 The training and welfare of expatriate personnel</u>

Over recent years, domestic construction enterprises have actively explored overseas markets with the "going out" policy, thereby, increasing a number of overseas projects and expatriates. How to manage overseas employees in order to realize a strategic advantage, and to expand in to the global market has been a difficult problem for CCFs. With respect to expatriate management,

how to develop a scientific basis, including a reasonable and effective expatriate salary welfare system for building a stable, international talented team had become an outstanding issue.

Wang (2006) indicated that expatriate failure was one of the salient problems of an organisation in overseas business. For example, the performance of the expatriate was generally lower than expected. According to statistics, nearly one third of the expatriate managers could not achieve their desired goals; additionally, a quarter of those joined rival companies once they completed their overseas work. This demonstrated that it was significant for CCFs to consider attracting capable employees to work overseas, and, moreover, to remain in the company. Interviewees pointed out that training and welfare were two main indicators to attract employees to work abroad.

One of the major challenges CCFs was facing was how to educate and nurture expatriates who understood domestic markets and possessed international business knowledge to meet the needs of global expansion (Liu 2014). Qin (2011) and Liu (2014) indicated that staff training could directly and systematically improve the employees' quality and to ensure expatriates had the capability to undertake overseas work. It would be an effective method to strengthen an enterprise's talent competitiveness.

Mr X revealed:

> *"It is quite important that a company provides training services for professional certification tests for overseas staff. Expatriates needed to work on large international projects abroad for a long time, but they often missed out on academic or professional certification examinations, thus, most expatriates did not have professional certification, although they had professional knowledge and rich practical experience, especially, those staff who participated in overseas projects once they graduated from university. Consequently, it would be better for the company to provide training courses regarding professional certification".*

Mr A explained:

> *"Most employees in a project department attended relevant civil engineering courses in university. But these courses were mainly designed for the domestic construction market. Thus, many graduates did not have a rich knowledge about global construction projects and the market. With an increasing number of overseas projects we have undertaken, we need younger employees to work abroad. Therefore, it is the CCFs' key task to train employees to gain international construction knowledge".*

Another major challenge facing CCFs was satisfactory welfare for expatriates. An attractive salary and welfare benefits went a long way to attract talent to work for enterprises. Dissatisfaction with pay was one of the primary reasons that employees wilfully gave up their employment (Motowidlo 1983; Shaffer *et al.* 2013).

Mr G said:

> *"Actually, an expatriate's salary was similar to that of the domestic employee; overseas staff's salary incentive was not very good, some core jobs, such as, project manager had no competitive remuneration, thereby, resulting in many employees not wanting to work on overseas projects. Thus, a competitive remuneration combined with good welfare was important for attracting employees to work on international projects".*

Ms W supposed:

> *"A company should provide attractive welfare schemes for overseas employees. Overseas projects in mainly developing countries, where there were poor environmental conditions and a heavy workload needed to address these problems. In order to encourage employees to participate in the project, a company could consider introducing better welfare for expatriates than for domestic staff, such as, paid vacations, visiting relatives, housing subsidies, transport subsidies, communication subsidies and medical insurance".*

Just as Shi *et al.* (2010) stated, a reasonable condition of staff's welfare was the embodiment of external competitiveness, also it was a basic safeguard in overseas market operations.

6.2.2.4 Factor of external coordination abilities

Concerning the interview results, two KCIs were classified as a factor of external coordination ability, they were KCI-51: understanding local values and idiosyncrasies, and KCI-4 involving social responsibility.

<u>KCI-51 Understanding local values and idiosyncrasies</u>

Cultural differences could cause a barrier in respect of entry. Therefore, a company should adapt to the social environment of the host country, such as, regarding a local religion and customs; it was important that the management philosophy of international business be explored through cross-cultural, beliefs and customs, in order to promote a sustainable development of the business model (Jiang 2015).

Mr G indicated:

> *"Sometimes, opposition between the overseas staff with local people and workers resulted from misunderstanding each other's values and idiosyncrasies, leading to Chinese staff not being able to communicate with local people and, inevitably, resulting in a lack of friendship with them".*

Mr K revealed his experience:

> "*I have been on a project in Laos. At the beginning, I, frequently, encountered conflict and misunderstandings with local people, because of a different culture, customs and ways of thinking. After I understood their values and idiosyncrasies, I made friends with them. So I consider that it is very important for CCFs in the international market, to concentrate on communications and approval between CCFs and local people*".

Mr P stated:

> *"International projects required CCFs to communicate within a different cultural setting. If CCFs did not understand the local culture, language, customs and taboos, it could prevent CCFs from becoming accepted in the local market".*

Gao and Liu (2010) explained that cultural differences created an omnidirectional impact on business operations. The gap revealed a huge difference between China's culture and the host country's culture, especially Western culture. Thus, cultural differences often resulted in communication difficulties. Cross-cultural conflicts were often caused by different patterns of behaviour. Cultural conflicts, caused by people from different cultural backgrounds, were one of the important reasons for the failure of transnational business.

KCI-4 Social responsibility

Social responsibility has been defined as the commitment to integrate socially responsible values and concerns of stakeholders in their operations in a manner that fulfilled and exceeded current legal and commercial expectations (Xiong *et al*. 2012). Corporate social responsibility was often considered to be one of the sources of competitive advantage. In a highly competitive, chaotic and ever-changing environment, socially responsible business behaviours were an effective and necessary strategy to ensure survival and sustainability (Frederick 1998; Huang *et al*. 2017). To the extent that businesses paid attention to social responsibility as a part of their corporate strategy, companies might be widely accepted in all target markets, and their existing status enhanced in the market (Galbreath 2009).

The interview results revealed that when compared with the top 100 firms, the non-top 100 firms paid more attention to social responsibility. Five Non-top 100 firms' participants rated this indicator as very important; however, only one participant in the top 100 firms rated it as very important. Additionally, three out of the four scholars rated it important and very important. It can be seen that social responsibility was an important competitiveness indicator in academic theory.

Two interviewees thought social responsibility was a fuzzy idea in a corporate operation. Ms I had a negative opinion with regard to social responsibility, she explained:

> "*Social responsibility is a propaganda method in order to improve company's image. However, how many companies truly carry out their social responsibility?*"

Moreover, senior lecturer AF considered:

> *"British clients will mention social responsibility, it will be there in the contract, important on paper and in theory, but not in practice and reality".*

Petrovic-Lazarevic (2008) indicated that large companies have implemented corporate social responsibility in order to be seen as good corporate citizens.

Mr H noted:

> *"Companies are a social organisation they are required to take account of social responsibility, since it relates to a company's image, and it enables clients to understand the company".*

Many participants considered that social responsibility to be one important business strategy as it enabled a company to improve its image, achieve a good reputation, including trust and approval in the international market. Some interviewees boasted their companies undertook social responsibility. Mr A, Mr C and Mr X stated that their companies paid attention to undertaking responsibility in society, a report concerning social responsibly was published every year to show which companies were undertaking social responsibilities to clients, in order to achieve clients' trust.

Mr R stated:

> "*It is quite important in the international market, to deliver CCFs' culture through undertaking social responsibility in foreign countries, it is good for CCFs' communication with local clients and to allow local societies to understand our company*".

A company which was considered socially responsible could benefit both from its enhanced reputation with the public, as well as its reputation within the business community, and at the same time increase its ability to attract capital and trading partners (Orlitzky *et al*. 2003; Zhao *et al.* 2012).

However, professor AE illustrated:

> *"Important in theory yet difficult to realise in practice. Who are you socially responsible for? Is it the person/organisation, who pays the salary to staff or the client, who pays for you? Or the wider community? Companies, some not all, had corporate social responsibility departments or officers – the extent to which they did this varied. In some projects local government imposes social responsibility on you, for example in the UK. If you are building schools, local government will insist you need to build a playground, you need to ensure that you build a railing between the school and the road, or perhaps you need to provide a public phone nearby, or perhaps clear signs or crossings for road users to clearly see children wanting to cross. All of these are social responsibilities. In some projects this is part of the contract – it comes in different ways. At times, people might say, we want 10% of all employees on site to come from this area. This is imposed mainly on public projects. At times, they do not depend on jurisdiction, according to country and locality it is, difficult to say – it is contextual. You have to understand the commitments, and the needs they have. At times, people may say that if it is not imposed by the local authority, it is just required to please the client, if they don't have to do it then they will not do it".*

Kuo *et al.* (2012) indicated that corporate social responsibility required national laws to enforce it. They explained that South Sudanese officials were worried about China's petroleum companies' social welfare and corporate social responsibility in South Sudan. South Sudanese officials believed that Chinese companies should increase their contribution to social welfare and transfer advanced technology and knowledge to the local market. Therefore, the parliament of South Sudan wanted to establish a petroleum commission, to pass laws to monitor Chinese companies' local social responsibility. Constructing Excellence (2004) pointed out that social responsibility mattered because the impact the construction industry had upon society was massive. Stakeholders who comprised the groups of people affected and/or were affected by the activities of an organisation were important. A firm needed, therefore, to identify and prioritise stakeholder groups and should enter into a process of dialogue with them to understand their concerns and explore ways of addressing them. Metcalf (2017) illustrated that corporate social responsibility in construction extended in many directions. Construction companies could promote corporate philanthropy through a variety of approaches. Construction companies had a

significant impact on the communities they built. Well-designed houses could improve quality of life, which in turn promoted good health. Community design and construction affected the social life of the residents and could even lower crime rates. Responsible construction affected all stakeholders: employees, suppliers, homebuyers, communities and even government.

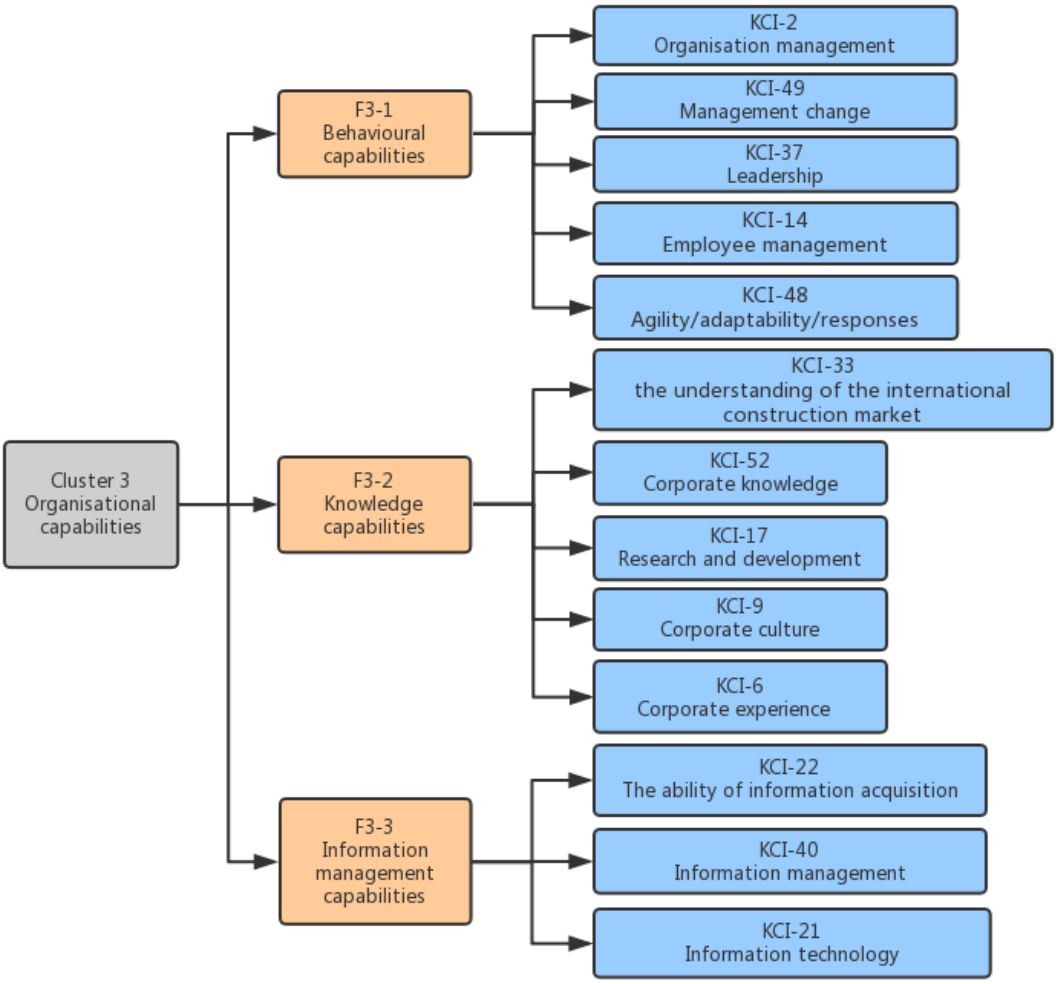
6.2.3 Cluster three: Organisational capabilities

Organisational capabilities are defined as a firm's capacity to arrange its resources, tangible or intangible, to perform a coordinated set of tasks or activities to improve its performance (Grant 1991; Amit and Schoemaker 1993; Teece *et al.* 1997; Helfat and Peteraf 2003; Inan and Bititci 2015). Organisational capabilities were fundamental to firms' ability to solve effectively their organisational problems (Dosi *et al.* 2000). A survey conducted by Roghe *et al.* (2012), found that organisational capability could be divided into subcategories to address structural capability, layers and spans of control, business analytics, behavioural capabilities, and the means to change management capability. Scott (2013) indicated that five essential capabilities every organisation should have were: leadership, collaboration, adaptability, creativity, and innovation. Inan and Bititci (2015) have developed a theoretical framework for organisational capabilities, which classified organisational capabilities into two categories: dynamic and operational.

Thirteen KCIs were divided into a cluster of organisational capabilities, including KCI-2 organisation management, KCI-33 the understanding of the international construction market, KCI-49 management change, KCI-52 corporate knowledge, KCI-37 leadership, KCI-22 the ability of information acquisition, KCI-40 information management, KCI-17 research and development, KCI-9 corporate culture, KCI-14 employee management, KCI-48 agility/adaptability/responses, KCI-6 corporate experience, and KCI-21 information technology.

These thirteen KCIs were separated into three factors (Figure 6.3): behavioural capability, knowledge capability, and information management capability.

Figure 6. 3: Cluster of organisational capabilities



Source: Author (2017)

6.2.3.1 Factor of behavioural capabilities

In respect of the interview results, four KCIs have been divided into the factor of organisation management ability, including KCI-2 organisational management, KCI-49 management change, KCI-37 leadership, KCI-14 employee management, and KCI-48 agility/adaptability/responses.

KCI-2 Organisational management

An organisation could be seen as a social arrangement for achieving controlled performance in pursuit of collective goals (Buchanan and Huczynski 2004:5). People interacted in some kind of structure or organized way to achieve some defined purpose or goal. However, as might be deduced, the interactions of people, as members of an organisation, needed some kind of managing, that is, there would be an element of coordination and control over their activities

(Senior and Fleming 2006: 4). Li (2006) indicated that organisational management was the basis and prerequisite for effective implementation of internal control. Enterprises should clearly determine the specific work, responsibilities and working requirements for employees. The authority and the relationship between each department and position within the firm should be clearly defined.

Mr L and Senior Lecture AC agreed that CCFs had their own unique organisational management methods, whose management methods were suitable for Chinese staff in China but not for international staff in other countries. Because Confucianism has had a very philosophical influence on management activities of Chinese modern enterprises (He 2011), which emphasized the value of collectivism; collectivism as a value always advocated maintaining harmony and cohesion within an organisation (Yeung and Tung 1996). Warner (2004) claimed that the Confucianism organisational beliefs, were closely related to loyalty, filial piety, honesty, and sincerity could strongly affect individual value systems within organisations, and the behaviour and attitudes of Chinese managers. Thus, Confucianism impacted upon Chinese enterprises by applying unique organisational management skills to manage Chinese staff. But He (2011) considered that Chinese firms had to change and adopt new management techniques in response to global business.

Mr O, Mr U, and Mr R stated that organisation management was core to achieving competitiveness, and should be the foundation for running a company. Many interviewees believed that organisational management referred to leadership, staff's working motivation and staff's working-efficiency, which could help staff to identify a company's values and goals, and it would also enable staff to estimate their value when working.

Mr Y, Mr N, and Lecturer AD noted that organisation management facilitated harmony and cooperation between different departments and subsidiaries. Mr Y noted:

> *"Organisation management capabilities are one of the important core competencies, it aids coordination and communication among different offices, departments and subsidiaries, in order to systematize the management within the whole company, it is very important for a company's development".*

Mr N mentioned:

> *"Organisation management is established in an organisation's structure in order to make clear the different departments' jobs, and to make sure all departments work together".*

Mr Q explained:

> *"Organisational management means that the organisation manages people's activities in the organisation. It mainly focuses on the management of staff in the organisation in order to encourage them to complete their work and realise an organisation's goals. This is very important in construction firms, especially, in Chinese construction firms, because many projects are connected to education. If companies do not make tasks clear, workers do not know what to do. So, organisational management is very important for Chinese construction companies".*

Additionally, Professor AE stated:

> *"No good project can exist without good organisation. It's that important".*

The author considered that a company's works, goals and development all required excellent organisational management to achieve its objectives. Good organisational management enables staff to work together, to improve cooperation between different sectors. It was about corporate structural management, which contribute to staff's ability to work effectively.

KCI-49 Management change

Management change has been defined as "the process of continually renewing an organisation's direction, structure and capabilities to serve the ever-changing needs of external and internal customers" (Moran and Brightmen 2001:111). An organisation needed to constantly change to retain their customers, keep abreast of technology and to maintain the ability to compete (Altamony *et al*. 2016). Successful management of change has been accepted as a necessity in order to survive and succeed in today's highly competitive and continuously evolving environment (By 2005).

Professor AE considered:

> *"The construction company wants to operate projects, to do so, it should demonstrate the ability to manage change, because you are coming to a new place, and everything around you are different from your own country's methods, consequently, with so many changes around you, you need to manage these changes. To be able to manage change; the context for any form of operation is different and needs managing".*

Mr H supposed:

> *"Domestic enterprises' management is more focused on the "rule of man": that is a management that is dependent on the trust and relationship between people, rather than*

management systems and processes which operate in Western companies. This special corporate cultural background is required to change for operations in global business".

Mr N described his experience:

"Our company plays a vital role in the domestic petrochemical construction industry. However, after we expanded into overseas markets, overseas projects' profits were diminishing. I thought the main problem was our company's management systems lack of control over overseas projects. Thus our company must change its management methods, mainly, to enhance information management, integrate the company's resources, and make decisions more quickly to adapt to overseas businesses".

Mr E explained:

"*Owing to the number and scale of overseas projects that have been expanding in recent years, our company's internal organisational structure has been unable to meet the needs of overseas business. Thus, management change is very urgent. For example, the management model is conservative and lacks innovation, the distribution of human resources is not balanced and the lack of effective performance assessment is evident. Therefore, our company made some management changes for overseas business, such as, by adjusting the management system to ensure overseas employees can effectively communicate with the parent company, and efficiently direct their working activities; additionally, to create innovative information systems, thereby, making the parent company better able to control overseas projects*".

Hao (2008) pointed out that the necessity for management change in construction firms: 1) global competition required Chinese construction enterprises to comply with international construction concepts and management methods; 2) construction companies must find new ways to manage overseas employees, in order to improve collaboration and communication, and to direct their activities to achieve a company's goals; 3) because of the diversity of overseas personnel who have experienced different education, cultures and ethnic backgrounds, the diversification of value concepts could bring challenges to construction enterprises.

KCI-37 Leadership

Leadership greatly impacted on relationships, work culture, collaboration, and outcomes when words, discourses and stories are realized as actions in the dynamic processes of organisational life (Hersted and Frimann 2016).

Mr B illustrated the reason for the importance of leadership in overseas projects:

> *"The manager in an overseas project is a temporary authorization leadership based on an employment contract. A short-term and temporary authorization leadership role restricts managers in the administration of staff in overseas projects, because of complications arising from team members from different countries, interpersonal relationships may result in a low level of trust. Sometimes, internal members tend to challenge the authority of project managers. In addition, the Chinese operate under a highly centralised leadership, to a certain extent, that serves to dampen employees' enthusiasm and creativity, which also make employees feel anger and resentment".*

Mr H said:

> *"Leadership is very important. As an enterprise manager, the first need is to fully understand the goals of different personnel, establish target incentives, and system boundaries, and allow them to develop space for realising their personal value. In addition, managers need to establish a suitable local personnel recruitment system, an effective performance evaluation system, and a rewards and punishment standard system that comply with local laws".*

Mr E explained:

> *"After the acquisition of foreign enterprises, instructive leadership is helpful for promoting the corporate operation at the beginning of acquisition. But with a company's development, a company will find it necessary to embed itself in the local culture, people and the market. Thus, an amicable and democratic leadership style is important for an overseas business".*

Senior lecture AD explained:

> *"A successful leader in an overseas project or branch requires a different leadership focus when dealing with relationships. Friendly relationships should be established with employees, in order to strengthen communication between team members. By establishing a good relationship with staff, it will be possible to solve staff's difficulties in work, and stimulate the employees' creativity and a sense of belonging".*

Sun Tzu (545-496 BC) proposed that a leader should possess these five characteristic: wisdom, integrity, kindness, bravery and severity. Wisdom meant that leaders should have vision, strategy and judgment. Integrity meant that leaders should have trust and prestige in an organisation. Kindness meant that leaders cared for employees. Bravery meant leaders had the boldness and responsibility to undertake risks. Severity meant leaders abided by an organisation's disciplines

and rules (citation from Fang and Liu 2015). Leadership was an important factor in contributing to organisational success (Spisak *et al*. 2015).

KCI-14 Employee management

Effective employee management played an important role in enhancing performance and building competitive advantage for a firm (Tang *et al*. 2015). Effective employee management practices attempted to improve employees' attitudes, abilities and motivation in support of a firm's strategic goals (Wright and McMahan 1992). Employee management could effectively improve labour productivity of enterprises (Dong 2015). International employee management played a crucial role in the delivery of the mission and strategy associated with a venture into foreign business. In order to achieve corporate business aims and objectives it would be necessary to adopt a suitable approach to human resource management, befitting the nature and scale of the organisation, together with the operational environment and the profile of the staff employed (Howes and Tah 2003).

However, Mr H was disappointed with CCFs' employee management, he explained that:

> "*This is not important for a Chinese state-own company, I found that state-owned companies' employee management was not transparent, they managed staff by 'guanxi'. In international projects, they just wanted someone who could work abroad to finish projects, they were not concerned about staff's purpose*".

Senior Lecturer AF doubted that it was important, he described:

> "*Look at FoxConn: it's not important. Or its importance is difficult to measure. Employees are interested in what they will be paid, and the time they will be required to work. Giving employees perks does not make organisations more competitive. FoxConn treats their employees like 'shit', but they are incredibly competitive. Different levels of employees are treated differently. On paper, it may be accorded an importance that is not reflected in practice. It is not a key factor in the reality of market competitiveness*".

Though, most interviewees held different opinions, they stated that talent was becoming an important resource in the state-owned enterprise's development, competition between enterprises was actually a talent competition.

Lecturer AD pointed out:

> "*CCFs are facing difficulties without highly qualified talent who know the overseas construction markets well*".

Mr K stated:

> "*This is very important for international projects, because we need to employ suitable persons who have international construction knowledge in different positions*".

A people-oriented management method has placed human resources as the most important factor in business activities; the aim of employee management was through scientific and effective management to improve staff's working efficiency and creativity to allow employees to make more contributions to an organisation's development (Dong 2015). Yang (2011) said that employees were an important resource for the future development of enterprises; it was the lifeblood of enterprises. The effects of employee management were: an analysis of the advantages and disadvantages of each employee; arranging for appropriate staff to undertake work, and to create a sense of belonging amongst employees, in order to improve employees' enthusiasm at work.

Mr D commented:

> "*When a company undertakes a project overseas, the company needs to consider what kind of employee the company wishes to recruit, what kind of staff can work overseas, how to train staff to improve their professional knowledge in order to meet the overseas market's demands*".

Mr B said:

> *"In my experience, I think employee management is not only about recruiting talent, allocating work to the appropriate person and rewarding staff, it is also about how making staff from different cultural backgrounds work together; allow expatriates to feel comfortable when working in overseas countries".*

Mr L explained:

> *"I considered that employee management for a company's international competitiveness is mainly concerned with changing management attitudes. In detail, a company sends Chinese staff to work overseas, consequently, Chinese staff's life and working environment have been changed, and they will work with international people and will work in a second language. How a Company manages these changes in order to encourage Chinese staff willing to work overseas is crucial. Or perhaps, some local staff need to change their communication ways in order to better communicate and cooperate with Chinese colleagues; a company's culture, perhaps, is different from their culture, so local staff need to change their mentality to blend in with the company, so it is important that the*

company is able to manage these changes, to ensure these changes are not detrimental to staff's working practices".

The author agreed with several interviewees, that good employee management promoted improving staff's working motivation, and to ensure the right person was in the right position, to improve staff's working effectiveness, to enhance staff's stronger cohesion and vitality, and to ensure staff's welfare and training and the ability to employ talent.

KCI-48 Agility/adaptability/responses

Globalization, new technologies, and greater transparency have combined to disturb the business environment and give many CEOs a deep sense of unease. All this uncertainty posed a tremendous challenge for making strategy. In order to adapt, a company must have its antennae tuned to signals of change from the external environment, to decode them, and quickly to act to refine or reinvent its business model, and even to reshape the information landscape of its industry (Reeves and Deimler 2011).

Mr L said:

"The host country's economic system and market environment are significantly different from the domestic market. These differences force a company and employees to understand, and to adapt, and to respond quickly to the new environment, in order to communicate better, and to cooperate in the local market".

Yang and Li (2007) indicated that adaptability was the ability of enterprises to change their activities in order to better adapt to the changing market. A company would strengthen its competitive position if it could actively adapt to changing market situations and improve its adaptability. An adaptive advantage has been described as a combination of various factors, which would result in the ability of a firm to adapt swiftly to a fast-changing environment (Koller 2016).

Mr G thought:

"International projects or branches require staff to adapt quickly to an overseas working environment, culture and new market. If CCFs do not recognise the importance of employees' adaptability, it could cause overseas staff not to integrate into the local society, which will result in low working efficiency. Thus, adaptability is important".

In addition, Mr R noted:

> *"Culture is the key factor for a company to adopt. Chinese culture differs from foreign countries' cultures, with respect to customs, taboos and religious practices. It is easy to cause unnecessary insult, if a company does not adapt to the culture of the host country".*

Mr Z described:

> *"Cross-cultural management has a great influence on overseas projects. My company trains expatriates to learn about project countries' customs, religious culture, political issues and marketing methods before being sent to a project. In order to improve the expatriates' adaptability to respond to the local market, this is essential. This would be a significant consideration when entering a local market in the future".*

An enterprise's adaptability was a comprehensive concept, mainly referring to an enterprise's ability to adapt to a changing market environment and to respond to market changes. Adaptability and responsiveness could enhance an enterprise's competitiveness in order to gain a dominant advantageous position in the market. Garg *et al*. (2003) showed that in fast-changing environments adaptive companies simultaneously scanned their immediate environment, for example, customers, competitors, and technology. This was in order to modify their internal systems associated with innovation, in order to achieve ascendancy.

6.2.3.2 Factor of knowledge capabilities

Five KCIs were classified into a factor of knowledge capability, including KCI-33 understanding of the international construction market, KCI-52 corporate knowledge, KCI-17 research and development, KCI-9 corporate culture, and KCI-6 corporate experience.

<u>KCI-33 Understanding the international construction market</u>

The initial phase of international business development was to establish a macro awareness, and an international perspective, and then would follow the need to understand the international market. Strategic goals and development strategies must be formulated based on market conditions (Zhu and Dong 1997).

Just as Ms W noted:

> *"An enterprise's business philosophy must be established on market principles, in order to develop a viable development strategy in the international market and realise international business development".*

Similarly, Mr O stated:

> *"The main goal of understanding the market is to determine a firm's market position, such as what kinds of project can be undertaken overseas, in which countries branches can be established for long-term development and what are our advantages in overseas markets. Understanding the market enables us to combine our company's strengths to reach the target objectives".*

Mr A expressed his firm's experience in overseas markets in order to describe the importance of understanding the market:

> "*Our group had a good start in overseas business. We set up branches in Nigeria, Oman, UAE, Thailand and Saudi Arabia ten years ago. But we lost competitiveness overseas, the key issues were that we lacked an understanding of the overseas market, our employees lacked the capability to research the market. This caused bewilderment, what could we do? We did not know our rivals and did not know the market's demands, so we lost many opportunities for large projects abroad*".

Caan (2013) believed that firms should research their competition and increased their understanding of the market. The market included customers, suppliers and competitors. These three were crucial factors, which defined the success of a firm's business. Throughout the journey in developing business or products or services, it was necessary for a firm to make sure to ask their customers what they thought at every stage and should be led by what they would buy.

Mr F thought:

> *"Understanding the global market is conducive to the establishment of the unique characteristics of enterprises and a clarification of market position. Thus, understanding the market is a powerful advantage when participating in the modern market competition, especially, in the construction market. With the 'going out' policy, more and more CCFs are active in overseas markets. Therefore, if construction enterprises want to grow, they must understand the international market, explore the market regularly, grasp market information, adjust their business strategies in accordance with the requirements of the market, rapidly respond to the market, and meet the market demands".*

Stewart (2015) illustrated that once entrepreneurs began the process of developing a strong business concept and model; they needed to consider the market they were about to enter. The key to success was taking time to thoroughly understand the market landscape, which meant investing in market research to analyse all aspects of the market. One of the key elements of pursuing a new business idea was to understand the market and those who were involved in it.

After having identified the market, a company needed to determine how to go and to enter it. It was most important that a company chose an entry point that would lead to the most future growth opportunities in the target market.

KCI-52 Corporate knowledge

Knowledge could be defined as a complex concept which consisted of information and skills acquired through experience, it embodied truth and belief, perspective and judgments, expectations and methodologies, it existed in individuals, groups and in organisations, in various forms (Hari *et al*. 2004). Knowledge could be viewed as a valuable resource or intellectual asset in an organisation (Ruan *et al.* 2012). Most organisations considered knowledge as the most crucial intangible asset to a company, which is possessed by employees, and if not carefully managed could vanish along the business line of the construction industry for various reasons, such as, the death of a staff member, resignation, job mobility or retirement (Idris and Kolawole 2016). Corporate knowledge included the facilities, schedules and techniques to acquire, create, share, and store knowledge among employees in the organisation (Donate and de Pablo 2015). Zhang (2012) indicated that enterprises could be separated from their corporate knowledge. Enterprises should be driven by knowledge to develop their business.

Mr E and Mr S supposed that corporate knowledge allowed CCFs to have the ability to guarantee enterprises' operations, a project's operation and business development. Corporate knowledge could improve a firm's research and innovation ability, and it was good for CCFs to apply their knowledge resources to promote and strengthen their business development, in order to improve a firm's competitiveness in such a changing market.

Senior Lecture AD clarified:

> *"Modern enterprises require building up knowledge of management systems, in order to achieve modern organisation management and project management. In the age of information technology, CCFs need to transfer their corporate knowledge to their competitive ability. The future of the world's economic development will depend on the accumulation and application of corporate knowledge".*

Knowledge has become one of the key resources for economic development, and human society has also entered an era of a knowledge economy. In this way, future economic activities will be based on a professional and service-oriented knowledge economy. Therefore, knowledge was the main economic resource of an enterprise. Enterprises must create new resources from existing knowledge (Pan and Sun 2010). Knowledge management involved knowledge identification, creation, acquisition, transfer, sharing and exploitation. Knowledge management was vital for

efficient working in projects and for improving organisational competitiveness (Lee and Egbu 2007).

KCI-17 Research and development

Investment in Research and Development (R&D) has become one of the priorities for both a country's development and a company's competitiveness (Laliene and Sakalas 2014). Mr D felt:

> "*We need to focus on R&D in technology, in order to demonstrate Chinese advanced technologies in the global market, it is as much about a firm's competitiveness, as it is about a nation's competitiveness*".

Many of the interviewees considered that R&D encouraged CCFs to employ innovative technologies for large project operations. Ms J and Mr N noted that it was important for a company to develop its own technologies.

Senior Lecturer AF considered:

> *"Taking a look at Microsoft, Apple, Hewlett-Packard and their constant innovations. Samsung is interesting – if they are strong on R&D then they will reclaim their place in the market. Even in construction, R&D exists in the sense of what organisations learn from their various projects around the world".*

Additionally, several interviewees considered that CCFs' innovative ability was weaker than in western companies, so improving R&D's ability to incorporate innovative technologies and to patent its own technologies would enable CCFs to explore the international market; otherwise, CCFs could lose out to competitors in the future.

Moreover, some interviewees considered that CCFs should not only focus on R&D in technologies; they required an R&D approach in their management methods, organisational structure and international construction knowledge, in order to meet the global market.

As Ms AB stated:

> "*R&D for CCFs consist not only in technology innovation, but also in organisational management innovation, CCFs should find a suitable business model for international business*".

Mr S manager of the international cooperation department in the NT5 Company noted:

> *"Many people think about innovation in technology, but I consider that organisational management should innovate as well. What management methods a company utilises, and how a company could improve working effectively with a new management method.*

If a company had a good management method to stimulate thought related to work, it could be good at innovation in technology I think".

However, Fairclough (2002) indicated that R&D has not been given sufficient priority in terms of expenditure as a proportion of turnover. The construction industry organised its resources around projects and although it was evident that considerable innovation occurred, and was funded within projects there existed a problem with institutional learning to instigate this innovation for future projects. Mr C mentioned:

"It is very important for construction companies to have their own technology, but it depends on a company's capability and financial support. Our company invests impressive funding annually for our expert team to research and incorporate patent technology, but sometimes it is a waste of time and money".

Egbu (2004) explained that organisations might innovate to increase profit share, to enter a new market, to be a leader or first follower in the market, for reasons of status. However, the organisation's innovation strategies were strongly constrained by their current position and core competencies as well as by specific opportunities open to them in the future. When managed effectively, innovation created possibilities for competitive advantage.

KCI-9 Corporate culture

Knowledge management has paid attention to corporate culture, every successful enterprise must have its own entrepreneurial spirit, and should apply common values to nurture all employees. A unique corporate culture would have a comprehensive impact on the realisation of management functions (Zhao 2004). George and Jones (2002) defined the term culture as to be taken to mean the set of shared values and norms that controlled organisational members' interactions with each other and people outside the organisation. Cultural norms could affect the way construction project teams communicated and behaved within a project environment (Ochieng *et al.* 2013).

Some participants considered corporate culture as referring to their working experience in the international market. They pointed out that it was difficult to communicate Chinese corporate culture with other countries' staff. Although corporate culture encouraged staff to work for a company's goals, and improve their sense of belonging, and helped clients to understand the company; it did not have major impact in the overseas market.

Senior Lecturer AC commented:

"It is not important to undertake overseas projects, international clients are more interested in the project's performance not in the corporate culture".

However, Arikan and Enginoglu (2016) considered that corporate culture was a significant component of organisational strategy and success. A strong corporate cultural structure provided certain competitive advantages to firms. Culture was the strong infrastructure at the back of the success of any individual or organisation. Organisational culture was a symbol of the unwritten feeling part of the organisation and it was often believed that it was so intangible and persistent that even members of the organisation could not be relied upon to make an accurate description of it. Organisational culture could be explained as a system of shared values and beliefs held by members that differentiated the organisation from other organisations (Dhingra and Punia 2016).

Many participants considered that corporate culture contributed to staff's sense of belonging, staff's morality and group cohesiveness, in order to build up a harmonious coordinated relationship in the company. Senior Lecturer AF noted:

> *"How people feel about the company they work for, is very important".*

Ms AB noted:

> *"It is one of the essential elements of an enterprise's concept. A healthy corporate culture will be able to weaken or even replace personal influence in an enterprise in order to create steady conditions for a company's development".*

Moreover, Mr Y stated:

> *"Company culture is one kind of standardizing role, including a Code of Ethics and a Code of conduct, this is important for a company delivering Chinese enterprises' ethics in the international market".*

Lecturer AC said:

> *"A company culture sometimes shows a national culture, but they are different. National culture is an ideology in citizens' minds. Corporate culture is the value of an organisation's development. But they have strong relationships. A company's culture somehow reveals its national culture, so corporate culture is important for Chinese construction firms operating overseas. Harmony in a company's culture enables a company's ability to integrate in the overseas market. Internationally, hosts could accept a foreign company's entry into their countries, because they feel the company's culture reflects their ideology. This is why Chinese construction firms undertake African projects over a long period, because most Chinese construction companies' corporate culture has delivered good project quality, working hard to build up a better tomorrow. This is what Africans want to achieve".*

Professor AE explained:

> *"Company culture is important because it provides the ethos which promotes respect and skill and knowledge sharing, all working hard for the organisation. This is important because it provides a sense of belonging and uniformity and common purpose 'we are all hard workers'. This differs from the culture of the country. Culture works in multiple ways: between national and corporate. A company culture that does not correspond with the national culture of a host country with a different cultural mind-set, which is alien to them, may struggle to feel that they can work with locals, and that may cause problems".*

Multiculturalism has become an important focus in debates in construction management research (Ochieng and Price 2010). Even when all construction firms were from one country in a project, the construction project manager might still have to deal with cultural diversity (Ochieng *et al* 2013). The prime role of cross-cultural management was to enables synergy between actors from different cultures who have been brought together to perform specific tasks. The main difficulty with cross-cultural management, in a successful international or global construction company, was the domination of its corporate culture over attempts to localize the organisation where responsibility and control was ceded to local managers rather than to expatriate staff (Howes and Tah 2003). The researcher has proposed that corporate culture was important, because it could increase a company's reputation and image, in order to express a company's goals, demonstrate a company's values, attract attention from other companies or clients, to allow clients to understand the company, and to acquire their trust in the market.

KCI-6 Corporate experience

Knowledge has been defined as the experience that people have accumulated in social practice. Knowledge could be seen as the sum of awareness and experience when people were in the practice of transforming the world (Gao and Ding 2003). Therefore, the author clarified corporate experience into the factor of knowledge. Corporate experience had an important guiding role for an enterprise's future survival and development. For example, firms tended to find new knowledge and information in areas where they have had a successful experience. Successful or poor experiences would affect future strategic decisions; a firm's experience played a role in the likelihood of intrinsic organisational outcomes, new product development, investment in R&D, innovative outcomes, and other areas of a firm's strategy (Coad *et al.* 2016).

However, some interviewees considered that corporate experiences could help a company understand the market, but an operational experience in one region could not be transferred other regions, and the market was changing quickly, the old experience might not be suitable under current conditions.

Mr L noted:

> "*Can the operational experience in Africa be suitable for UK market? I don't think so"*.

Mr P, Mr U and Lecturer AC considered that experience meant the work that company did in the past. However, a corporation's previous experience was not sufficient to be applied to a new market's development, owing to the construction market's rapid development. It was much more important that a company should have appropriate development plans to correspond with the changing market.

In the process of business operations, many companies were prone to make mistakes when involved in a market, in which the company did not have operational experience in order to rapidly expand its business, which could cause a company to fail in business operations in that market. So business experience was a valuable asset. But the experience might not be suitable to be applied in a current operation, which required enterprises to make in-depth analyses and rational judgments pertaining to a specific market. Therefore, it was necessary to combine corporate experience with existing corporate knowledge to improve an enterprise's development (Lin 2006).

Mr H mentioned:

> *"International project experience furthered a company's knowledge of the market and helped to understand how operations could be successful in a market; what kinds of projects a company should undertake, which regions a company should enter, these were important considerations to explore in a new market, and should continue to be considered in the original market*".

Mr H said:

> *"Corporate experience increases a company's knowledge about how to operate projects in the future. When I joined the bridge project in Vietnam, I felt our construction processes were very good, with respect to appropriate technology, safety concerns working high above the ground, completing daily schedules, and establishing effective project management plans. These good factors came from our project operational experience, so we knew how to operate and how to improve performance in other projects. But sometimes, experience was not useful in everything, our company focused on bridge and road projects, if we were asked to construct a building, perhaps, we could not do it very well".*

Similarly, many interviewees stated that corporate experience assisted CCFs in designing business strategies to compete with rivals. For example, a company was better able to analyse market

issues, understand a company's advantages and disadvantages in different markets, forecast business trends, controlling risks, and gaining marketing information.

Mr Z noted:

> "*Experience enables a company to make good business strategy through a combination of previous experience and current market information*".

Mr K said:

> "*It is important to stay in existing markets, and hinder new companies' entry into the market, because a company's experience equips a company to understand the market well, consequently, a new company could lose out to competition when they come to bid for a project in the same marke*t".

Several interviewees noted that corporate experience was one of the important factors that demonstrated a company's capabilities in international markets. Mr A and Ms AB said that corporate experience could reveal a construction company's capability. What kinds of projects a company undertook previously, how many projects were completed, which market the company now occupied, and how successful was its previous financial performance. These experiences were one symbol a company's capability, and clients could trust a company if they knew which projects the company had completed previously.

6.2.2.3 Factor of information management abilities

Three KCIs were divided into the factor of information management ability: KCI-22 the ability of information acquisition, KCI-40 information management, and KCI-21 information technology

KCI-22 The ability of information acquisition

Rapid growth in product variety, and continuing shifts in consumer preferences have both led to increased market uncertainty. To implement more targeted marketing strategies, firms have been advised to understand better their potential consumers before entering new markets (Schullz *et al*. 1993). Therefore, in practice, firms have invested in many data acquisition infrastructures, have hired professional research teams and/or purchased internet cookies to collect and analyse consumers' purchasing behaviours (Guan and Chen 2016). Boisits and Konigsgruber (2016) indicated that information gathered in order to improve internal decision-making was also useful for predicting a firm's prospects.

Ms. AB described:

> "*We behave like a leopard to quickly and correctly judge where we can acquire marketing information and how to obtain it, in order to achieve comprehensive and accurate marketing information; and, thus, draw up a feasibility analysis in order to enter a market. We cannot know market changes and demands without information acquisition. By the way, accurate marketing information is the key for a company's business development, wrong marketing information could make us decide to implement wrong business strategies. For example, a Chinese construction firm has been operating a magnetite project in Australia. However, they did not gain correct information about this project, wrongly assessed operation costs, which totalled an investment of $10 billion dollars more than three times the original budget and, thus, this project was delayed for four years. Consequently, the accuracy of information acquisition is very important*".

Mr H said:

> "*It is important to gain information before a project's operation, including local material prices, labour, and a project's surrounding environment, transport, and regulations, and laws. All this information should clearly precede construction, otherwise a project's duration and economic success could be affected. However, this information is not easy to acquire in overseas markets, this is a challenge for staff in the marketing department, they are required to possess the ability to gain marketing information. If they cannot obtain correct marketing, and project information, our project department cannot design appropriate project management plans*".

Mr V described:

> *"My company tried to bid for a road project in Romania last year. However, many counterparts suggested we abandon this project. So we needed to collect project information from multi-channels, including from Romanian and Chinese governments, design consultant firms, accounting firms, law firms, and rivals; moreover, we negotiated with a French and an Italian construction company in order to obtain some important project operational information. The valuable information we gained supported our decision to give up bidding immediately".*

Enterprises' information acquisition ability must improve to correspond with the expanding social or market information. Companies with strong information acquisition ability could quickly and accurately acquire a large amount of market information, which included external environmental

changes and information about competitors. This was because enterprises could formulate a strategic approach and respond quickly to the market (Jiang 2012).

KCI-40 Information management

In the 21 century, an international concept of information management, as a special section of self-management in the economy, was formed. Information management provided a permanent transformation of the business environment, and was able to identify a successful business (Eroshkin *et al.* 2017). Han (1995) noted that information management was a strategic tool for an enterprise's business. It included information collection, processing, transmission, and storage. It was important that enterprises established an information management system.

Mr B explained:

> *"CCFs do not have a deep understanding of information management. Most enterprises thought management information referred to searches on the Internet and receiving mail; they did not have a concept about applying information management to strengthen an organisation and coordinate management, predict market changes and identify project risks. In terms of attitude towards information management, most companies are willing to adopt it, but they worry it could increase extra workload".*

At present, enterprises business information management has become a major guarantee for improving a firm's competitiveness in the market. It was mainly available in a variety of software services to manage a firm's business information, which included client information, market information, and employee information (Ma 2016). Information management capability played an important role in assessing other firms' capabilities, for customer management, process management, and performance management. In turn, these efficiencies favourably influenced customers, improved financial, and human resources, and organisational effectiveness measures that influenced a firm's performance (Sunil *et al.* 2011).

Mr P stated that an overseas branch and subsidiary required an enterprise to establish an information system to manage diversified businesses. Information management was very necessary for project management.

Mr S illustrated the point:

> *"CCFs must establish a good information management system. Because many CCFs' information communication was not smooth, lacked sharing of information and could not support an enterprise's global business development. This has revealed poor quality of financial information, slow disclosure, unsubstantiated analysis reports, and could not benefit a manager's decision-making. Companies could establish a global sharing*

information system, in order to realise global efficiencies, access, and track business information; in addition, to improve operational flexibility, increased transparency, and enable managers to focus on core competitiveness".

KCI-21 Information technology

Firms commonly invested in information technology to create innovative processes, and to achieve an enterprise's overall cost reduction. The role and importance of a firm's information technology was necessary for the successful absorption of external knowledge and the realisation of economic gains from innovation (Trantopoulos *et al.* 2017). Ji and Zhou (1998) pointed out that information technology could be summarized in four categories: 1) automated design and production systems, which could greatly improve labour productivity, and product quality; 2) the business processing system, which would allow business personnel improve their work efficiency in collecting a large amount of tedious data; 3) information management systems, to manage a company's comprehensive information, to strengthen statistical, analysis and reporting capabilities to meet the needs of managers; 4) decision-making information systems, to assist managers with decision-making. This did not simply mean implementing the latest technology, it also helped to create appropriate information products, set up applicable processes, manage suppliers, construct appropriate further training, and, in particular, to manage customers' entire knowledge base. Therefore, building up a proper IT strategy, and its implementation was a key topic and a big challenge for a modern enterprise (Chew and Gottschalk 2008).

Several interviewees considered that in the era of information systems, information technology enabled an organisation to modernise.

Mr Q said:

"*In the face of challenges in the global construction market, information technology is becoming one of the important factors relating to competitiveness, it helps firms obtain the latest business information, and helps a company to respond faster in a changing market*".

Companies were motivated to use information technology, not only to support their businesses, but also to improve their efficiency and effectiveness. To be successful in the market an information technology service provider must be able to continuously offer effective, cost-efficient and up-to-date technology. At the same time, an information technology service provider must support the current activities of their customers and assist in any future developments with the appropriate technology (Gerdewal and Secim 2014).

Mr M illustrated the point:

> *"I understand that information management is an IT system, which allows company staff to upload and share their working progress in order for a company to control whole organisational management. It is important, especially important, for a company to supervise international projects, and ensure international projects are on track".*

Mr Z considered:

> "*It could help a company to realise that automated management, improves the working efficiency and enterprise of management, and, thus, enhances the modernisation of management, when establishing a modern enterprise system, effectively reducing costs, speeding up technological progress and enhancing core competitiveness, this is very important for a company to initiate more business in the international market*".

Mr G said:

> "*It consists of improving project management, but I think our company needs to improve IT management in organisational management in order to enhance staff's working effectiveness*".

Some interviewees noted that IT enabled them to manage project plans. Ms I stated:

> *"During the duration of a project's design to construction completion, information technology is necessary to collect and analyse data in order to manage a project's progress".*

Moreover, Lecturer AC stated:

> "*Information technology management assists the company in managing operational transparency in overseas projects, solve non- transparent issues of construction progress and business operation activities*".

Mr P noted:

> *"Information technology is a platform to link contractors, subcontractors, investors, and the market in communications, these people work together for a project, information systems facilitate their effective communications and follow each construction stage's progress. If any problems have happened, they could communicate and analyse any problem through information systems".*

As Egbu and Howes (2001) noted that communication was a vital part of organisational activity and information technology had a central role to play in communication within and across organisations.

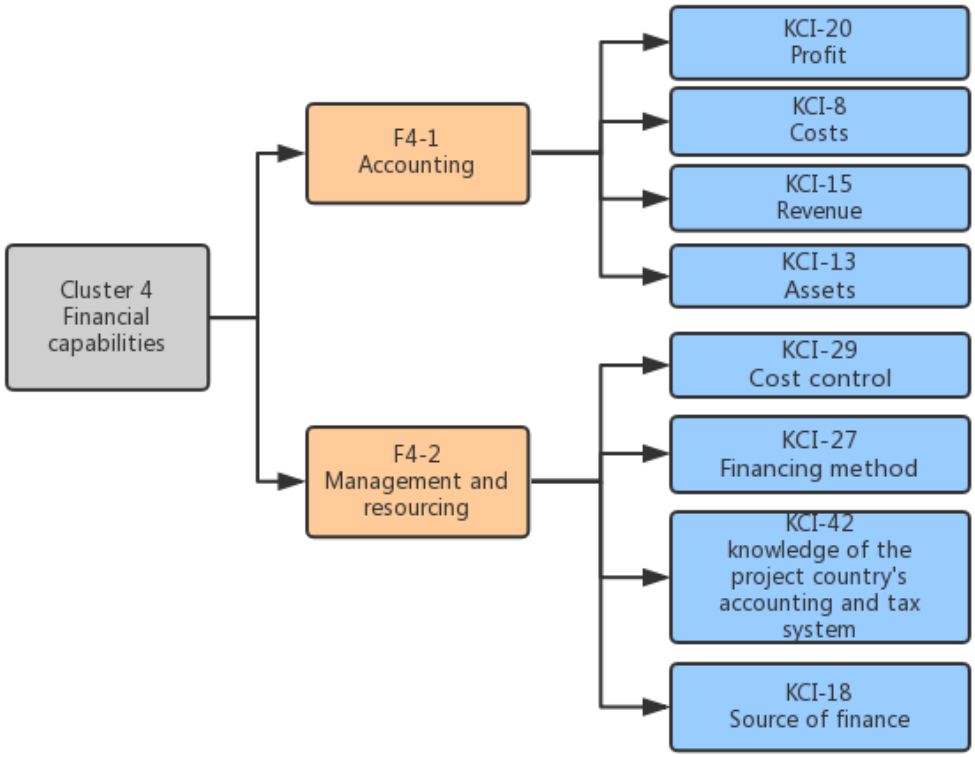
6.2.4 Cluster four: Financial capabilities

The Financial Services Authority (2005) indicated that financial capability had four discrete aspects: managing money, planning ahead, making choices, and getting help. Institute of Chartered Accountants in England and Wales (ICAEW) (2011) stated that the nature and content of finance activities included: accounting, compliance, management and control, strategy and risk, funding and management, and resourcing of activities.

Eight KCIs were divided into the cluster of financial capability, including: KCI-20 profit, KCI-29 cost control, KCI-8 costs, KCI-27 financing methods, KCI-15 revenue, KCI-13 assets, KCI-42 knowledge of the project country's accounting and tax systems, and KCI-18 source of finance.

Furthermore, these eight KCIs were classified into two factors (Figure 6.4): accounting, and management, and resourcing.

Figure 6. 4: Cluster of financial capabilities



Source: Author (2017)

6.2.4.1 Factor of accounting

KCI-20 Profit

Generating positive profits was one factor to enable a firm to be successful (Dutta and Radner 1999). Zhou *et al.* (2016) indicated that profit was a goal of an enterprise's business. It was the final result of an enterprise's production and operation, and was related to the vital interests of investors and employees. The main goal of managers should be to organise a business operation to obtain maximum profit for a company. Han *et al.* (2007) noted that major problems to be addressed in international construction projects were lower levels of profit.

From the interview results, many participants thought profit very important for a company's operation and growth. Ms I, Ms J, Mr K, Mr V and Mr S stated that profit maximisation was a company's goal and profit was one of the main purposes when undertaking projects.

Mr O noted:

> *"A company's further development requires positive profits to be obtained, moreover, shareholders want to see good profits, which the company makes for them*".

Several interviewees considered that profit was related to a company's operations, and survival in the market. Mr N noted:

> "A *company would become bankrupt without obtaining profit"*.

Some interviewees pointed out that it was the most important financial performance factor to evaluate whether a company was successful or not. Mr M said:

> *"A company cannot expand and cannot maintain survival in the market if a company does not pursue profit".*

However, Anthony (1960: 127-128) illustrated the point: "*if profit maximization is the governing objective of business, such a statement is nonsense. And I am quite sure that it is not… I suggest that the objective of a business is to use its resources as efficiently as possible in supplying goods and services to its customers and to compensate equitably those that supply these resources. As a way of making this general statement operational, I suggest that that the objective be considered as earning a satisfactory return on capital employed*".

Six interviewees mentioned that profit was required when considering in which region construction markets operated. Just as Mr L explained:

> *"It depends in which market a company undertakes projects, if projects in an existing market, earn profit that is the company's goal, but if a company wants to enter a new*

market, we do not consider profit first, we consider how to win the project even if it is necessary to reduce profits".

Mr X explained:

"Winning the project is much more important than achieving profit, a large construction firm could afford to lose profit on a project; whereas a small construction firm could earn positive profits, so profit alone cannot determine a company's competitiveness".

Lecturer AD stated:

"Perhaps a construction team could reduce costs by using cheap materials in order to achieve profit maximisation, but this could affect a project's quality, so if a company wants to undertake international projects, a company must ensure a project's quality first, and then think about achieving positive profits".

Professor AE explained:

"Profit is not a big issue for Chinese firms, non-profitable projects may be necessary for entry into a new market, but a firm cannot survive indefinitely without profit, For some firms, profit is not an initial concern; they can manage by breaking even for the first year or on the first project in order to establish themselves in the market. There is a difference between a profit making organisation, and those in the non-profit sector such as non-governmental organisations or Defence".

<u>KCI-8 Costs</u>

Project costs involved expenses, which have been incurred in a project operation, including human resources, material resources and other production and management costs (Xie *et al*. 2003). In a competitive market, competition between enterprises would gradually transfer from product quality competition to price competition, thereby resulting in construction enterprises making less profit. Thus, costs have resulted in a major issue in profitable organisations (Meng 2007).

Many interviewees mentioned that cost was very important for construction companies, it directly affected a company's profit; to be cost-effective was a feasible way to achieve profit maximisation.

Mr P stated:

"All business activities need to consider costs".

Mr M explained:

> *"Costs are a very important indicator in financial performance, at project level, the best way to win projects is by reducing costs in order to achieve a low bidding price; at a firm's level, reducing running costs could obtain higher profits".*

Mr AA said:

> *"Construction enterprises must strengthen cost management, control cost effectiveness, and improve budget management expertise, in order to reduce wasting funds, and achieving maximum profits".*

Ms AB and Mr Y mentioned that the cost of materials, both non-quantifiable and quantifiable were inevitable in a project, but some could be spent on some costs, such as, offices, management, and daily expenses might be reduced. That might help a company increase its profits.

Cost estimates prepared in the early stages of a project allowed a client to evaluate tenders, secure funding, and/or perform a cost–benefit analysis. Determining the causal nature of cost overruns was, arguably, a complex and challenging exercise. Needless to say, the construction industry has earned itself the unenviable reputation of delivering projects late and over budget, again and again, leaving clients dissatisfied and the taxpayer often out of pocket (Ahiaga-Dagbui *et al.* 2017).

Several interviewees considered costs' importance depended on context. Lecturer AC explained:

> "*Operating costs are essential for any business activity, reasonable investment in operating costs could help the company achieve positive profits. But for large overseas projects, we should invest an amount to cover operational costs, moreover, project costs are not easy to determine, because some circumstances could happen in a project which could cause costs to increase. So I do not think this is an important competitiveness indicator*".

Mr T and Mr F considered that cost-efficiency could increase profits. But considerable capital is required to be invested in order to enter a new market. Sometimes, a company wanted to increase capital expenditure to enter a new market.

Moreover, Mr H mentioned that cost-effective issues related to the bidding price, he explained:

> *"We are required to calculate costs before bidding for a project, and to try to reduce costs to achieve a reasonable bidding price to win the project".*

Mr E said:

> *"Cost is the one of key factors we consider when bidding for a project, low costs mean a low bidding price, which enables us to have the opportunity to win the project".*

Mr R said:

> *"Construction enterprises must have their own normal management system, budget management system, and measuring and acceptance system, in order to calculate cost-effectiveness, and profit maximisation in the bidding phase".*

Li (2016) pointed out the different costs between domestic projects and overseas projects. There were additional costs and risks in overseas projects. 1) the project agency fees, mainly for the employment of local advisory agencies or government agencies to carry out pre-project promotion, and to follow-up on production issues; 2) the cost of imported materials, part of the materials might need to be imported from China or a third country to the project country, that might cause the project cost to be increased because of the shipping fee, customs fees, import and export fees, and port security fees and insurance; 3) the risk costs relating to the exchange rate, overseas employees, and price adjustments. Many projects were calculated in US dollars or in local currencies, the exchange rate of those currencies directly affected the project costs. The vast majority of local staff would be involved in technical work, which required high salaries, so the degree of localisation would directly affect a firm's operational costs and project costs. The risk of price adjustment could increase project costs, such as, tariff adjustments and any increased oil price would have a huge impact on project costs.

KCI-15 Revenue

An enterprise's revenue was the fundamental basis for an enterprise's survival and development. Positive revenue played a decisive role in long-term cash flow, and an enterprise's sustainable development. Also, it determined an enterprise's competitive level in the market (Dong 2012). But not all earnings would be necessarily paid out to investors, because retained earnings might be reinvested, used for working capital, or used as insurance against a future shortfall of working capital (Dutta and Radner 1999).

Some interviewees pointed out that revenue was important, but depended on different operational situations. Mr H illustrated the point:

> "*I understand a company wants to obtain revenue, but in a new overseas market, we do not consider revenue in the first project, we want to make a long-term relationship with foreign countries' government and consumers, so we can accept a low revenue from a project at the beginning*".

Mr T explained:

> "*It is an important index of financial performance to show how successful a company's operations are in the market, but, actually, CCFs do not care about revenue in international projects, one reason is subsidised projects, the other reason is that CCFs received funds from the government, thus CCFs could undertake an uneconomic project in order to enter a new market*".

Lecturer AC pointed out:

> *"Revenue can reveal a company's market share in the market, but it cannot show how much profit the company earns, because different projects in different markets have different costs".*

Some participants rated revenue as very important. Mr B noted:

> *"Why do we want to explore overseas markets? One of the reasons is that we want to have more international revenue and thus occupy more of a market share in the global market".*

Ms J, Mr K and Mr Y thought good revenue was an important index to evaluate a company's market share and liabilities' responsibility. Mr M stated:

> "*One of the goals of CCFs' operations internationally is to earn long-term revenue from different markets*".

KCI-13 Assets

Assets referred to many things, here assets constitute financial assets. Financial assets were an important part of an enterprise's total assets, including inventory cash, bank savings, accounts receivable, bills receivable, loans, other receivables, equity and debt investment (Gao 2015). The significant feature of financial assets was that it could provide immediate or long-term monetary revenue flows to its owners from market transactions (Tian 2012). Thus, financial assets had a significant impact for an enterprise's operations (Teng 2011).

Most participants rated this indicator as important or very important. They mentioned that assets contributed to disclose a company's steady financial capability. Mr D and Ms J noted that it was one of the important financial indicators to support a company's operation. Mr E said:

> "*It is important to keep a company's assets stable, otherwise, it could result in shareholders and consumers losing their trust*".

Ms W said:

> "*Assets demonstrate a company's financial strength, good financial assets mean a company has a good financial performance, this is very important at the bidding stage; additionally, investors understand a construction company's financial performance by its assets*".

Mr Y noted:

> "*Company assets enhance a company's internal stability and serve to improve competitiveness in the market, a company does not worry about capital when expanding business overseas*".

Professor AE explained:

> "*Clients want to find out a company's financial ability, they don't want you to be declared bankrupt when you undertake a project for them. Companies entering the UK have to pass a threshold of assets and financial viability – the client wants to be certain of the contractor's financial stability, they do not want them to go bankrupt in the middle of a contract. This is part of the procurement; financial good health is first and foremost*".

6.2.4.2 Factor of management and resourcing

KCI-29 Cost control

Cost control was important and has always been an important issue, and, perhaps, most important in today's unpredictable market. It was the responsibility of management to control the costs, which had been incurred throughout the process during product design, production, sales and after-sales service. Cost management performance affected the efficiency of an enterprise's production and operation, and then directly affected an enterprise's competitiveness, survival and development in the market (Liu 2007). The issue of cost control management was necessary in the operations of companies in order to adequately utilize material resources. Furthermore, cost control involved management measures implemented to ensure that cost reflected accordance with management plans (Olalekan and Tajudeen 2015). However, Mr F and Mr T stated that construction enterprises in China were a labour-intensive industry. Many construction enterprises acted regardless of cost, in order to enter an international market or to correspond with the country's policy. Thus, considerable cost is wasted in the construction process.

The best-run companies considered cost control was a way to support their strategy, and that cost, as a precious investment, would fuel growth. They put their money in to their strategy, is

and continually cut bad costs, and redirected resources toward good costs (Leinwand and Couto 2017). Hicks (1992) contradicted that view, regardless of management competence, and the financial strength of the contractor, accurate cost estimation at an early stage was the key to avoid cost overrun in projects.

Mr B explained:

> *"A large overseas project needs more materials, machinery and equipment. However, when our company's overseas projects, mainly in some developing countries, materials and equipment need to be imported owing to their poor productivity, and modest economic development, this has increased pressure on costs in overseas projects".*

Senior Lecture AD added:

> *"Cost control is very important in international projects. Because overseas projects' costs are different from domestic projects, such as equipment costs, material costs, labour costs, and taxes. For example, construction firms are required to pay delivery fees for equipment, and materials' deliveries, and have to pay an acceptable salary for local staff. Construction firms must establish a cost supervision system to regulate each expense in projects, in order to ensure projects achieve merit quality at reasonable costs".*

Mr A illustrated the point:

> *"My company undertook a light rail project in Mecca. But after construction, this project faced difficult demolition fees and an increase in the cost of supplies, which caused a sharp rise in costs. However, this project was very important for the relationship between China and Saudi Arabia. Thus, we had to continue to invest considerable costs to guarantee that the project was completed on time, resulting in huge losses".*

Cost control during the construction process was vital to ensure the success of a project. Construction project managers and cost engineers had the challenging task to build a complex project that was on budget. Cost control was needed in the construction project management field because of the high level of uncertainty associated with the cost of building complex structures. Although there was a potential for projects to be completed under budget, the complexity involved in construction required specific attention to cost control in order to achieve favourable results. To be most effective, over the life cycle of a project, a cost control system must be applied to both the planning and execution phases (Bender and Ayyub 2001). Similarly, Olalekan and Tajudeen (2015) stated that the importance of cost control could not be over-emphasized as a survival technique for companies, because they must ensure proper monitoring of costs against the budget, and any financial impropriety in the company must be corrected.

KCI-27 Financing methods

At present, many Chinese construction firms did not obtain outstanding investment from shareholders, causing these construction firms to possess high debt and low operational capital (Gao *et al.* 2003). Thus, Chinese construction firms have been required to select an appropriate financing strategy based on their actual situation, in order to maximise their financial capacity, and to reduce financial risk. Some financial methods enabled construction firms to obtain project contracts with help from investors, and, consequently, to ensure construction firms earned a reasonable profit (Xie 2005). Huang and Qin (2007) indicated that an attractive financing method contributed to a construction enterprise's survival and development in the international market. Financing methods included: ownership financing, debt financing, Build–Operate–Transfer (BOT), Transfer-Operate-Transfer (TOT), Public–Private Partnership (PPP) and financial leasing.

Mr R explained:

> *"In general, those CCFs undertaking international projects mainly rely on export supplier credit financing, which has assisted CCFs in obtaining a certain market share. But it will cause some disadvantages for CCFs if CCFs over rely on supplier credit to develop in an international market. For example: such loans will appear in the form of debt in corporate balance sheets, which must raise questions concerning an enterprise's balance of assets and liabilities, and thus affect the enterprise's refinancing ability".*

Mr E said:

> *"CCFs often undertake projects using their own capital, resulting in a financial shortfall for many CCFs. Funds and financing issues are bottlenecks in the development of international projects. In the implementation process of the project, construction firms must have sufficient finance, otherwise it poses difficulties for project operations. Thus, it is necessary for CCFs to consider appropriate financing methods".*

Ms J explained:

> *"Because China's overseas construction markets are mainly distributed in developing countries, such markets lack funding for their infrastructure constructions. Therefore, CCFs need to adopt suitable financing methods to expand in overseas markets for two goals: one is investing in a variety of projects designed to promote the development of overseas markets; the other one is solving issues of sourcing finance in the Engineering Procurement Construction (EPC) project to ensure a company obtains sufficient funds for a project's operation".*

Financial methods became one of the important factors to affect the scale in the international construction market, and construction companies' market share, because it allowed construction companies to invest in projects and encouraged potential shareholders to invest through various types of financial methods, Therefore, CCFs should actively promote innovative international project financing methods to enhance their international competitiveness (Guo 2013).

Mr C stated:

> *"The development of export credit, and an export credit insurance system in China is not yet mature, this limits our global construction enterprises' competition with foreign counterparts. China's traditional export markets have been focused mainly on developing countries in Africa, Asia and South America, where there is a high risk in the political sphere, finance and in business dealings. Consequently, a lack of risk management ability in China's export credit and export credit insurance institutions, has resulted in expensive premium rates, thereby, increasing the burden of cost to Chinese enterprises when undertaking international projects, and, thus, reducing the international competitiveness of CCFs. But, if CCFs could purchase large capital equipment for overseas projects through foreign preferential government loans, and mixed loans, CCFs would benefit. Mixed loans are foreign government concessional loans combined with foreign Banks' commercial loans, For example, our company purchased four shield tunnelling machines through mixed loans".*

Mr X considered:

> *"It is necessary to apply to China's foreign aid loan and preferential export buyers' credit. In addition, government could persuade financial institutions to increase financial support for construction companies. At present, only the Asian Infrastructure Investment Bank and One Belt One Road Fund have been established. However, the Asian Infrastructure Investment Bank has around $100 billion dollars, One Belt One Road Fund has around $40 billion dollars, which capital would not be sufficient for Chinese firms to undertake more overseas projects, and it still requires more financial institutions to support financing overseas projects".*

Ms AB pointed out:

> *"The general pathway is to establish joint ventures in local countries, this allows local government, local enterprises and local financial institutions to participate in Chinese projects, which will enable CCFs to obtain international finance and reduce project risks".*

KCI-42 Knowledge of the project countries' accounting and tax systems

Each country had different financial policies, accounting procedures and tax systems. Those different systems between China and local countries have increased the difficulty of financial management in overseas projects. Financial management in respect of the local country's financial systems, and financial management differences between China and the project countries have been perceived as urgent problems for CCFs (O'yang 2010).

Mr C stated:

> *"Overseas projects' tax payments, accounting methods, and complex accounting rules, and regulations between China and host countries, require CCFs to employ professionals who understand international or local accounting tax systems".*

Mr K explained:

> *"Many CCFs are unfamiliar with overseas tax management systems and lack experience with tax disputes, caused by project-host countries' strict regulation of Chinese enterprises. Consequently, it is very important to know the project country's accounting tax system in detail".*

Understanding a host country's financial background, accounting systems and regulations was an important consideration in financial management in overseas projects. This was because an overseas project's accounting and tax methods must meet the requirements of the local taxation system, and a firm must provide correct financial information to comply with local regulations (Li 2012).

Mr N demonstrated:

> *"My company undertook an EPC project in Pakistan. The project has received, surprisingly, a Pakistani tax payment invoice. The company has cooperated with local professional tax advisers to ensure that this project should enjoy local duty-free treatment. At the same time, the company also analysed two other similar projects, which were operated by Chinese enterprises that did enjoy duty-free treatment; in order to completely prove that this project did not need to pay tax".*

Ms AB illustrated:

> *"Compared with advanced accounting and tax systems of large global companies, CCFs did not possess a complete accounting and tax management system, and a special overseas tax management position. In the process of overseas investment, CCFs should pay particular attention to tax management. Otherwise CCFs would be restricted in their*

attempt to build a modern multinational enterprise in an international competitive market".

Mr Y said:

"Companies could lose out economically in projects if construction enterprises were not able to clearly understand a project country's tax system, and, if enterprises could not find out measures for reducing tax bills, and enjoy duty free status from accounting and tax systems, enterprises would suffer, Therefore, it was essential to actively plan overseas accounting and tax management schemes, to reduce overseas projects' tax burden whilst still abiding by local laws. This was, particularly, important in the overseas project's operation, as it could improve a company's international competitiveness".

KCI-18 Source of finance

In order to undertake a new venture involving significant investment, cash would be needed to be raised by using reserves within the firm or by disposing of assets, or by borrowing. Therefore, investment could be classified as a short-term measure to support operations, medium-term to purchase equipment or facilities, and long-term to be associated with the expansion of an existing business, or through acquiring a new business (Howes and Tah 2003). A firm could fail if it was either unable to attract finance or if it ran out of working capital (Dutta and Radner 1999).

Many interviewees considered that source of finance affected a company's capital and cash flow. Mr D stated:

"*More sources of finance, more capital, were important for entry into a new market, source of finance was important for us to obtain money in order to run projects and the company*".

Mr AA said:

"Reliable sources of finance directly affected a company's stable development, a company's business activities, and construction activities, thus, a company must be in possession of a stable source of finance in order to ensure the company and a project's operations continued".

Currently, there were three main sources of finance for CCFs' overseas projects: 1) the projects supported by a political bank, such as, the World Bank, and the Asian Infrastructure Investment Bank; 2) government concessional loans for projects; and 3) government budget projects. Global construction firms needed to look actively for international cooperation opportunities with

respect to their own situation, in order to acquire a positive source of finance, so that they could enjoy a healthy long-term development in the competitive international market (Li 2016).

Mr F, Mr G, Ms J and Mr Z thought that it was important when entering the international market, to consider how much capital a firm could invest, and how many loans or funds a firm could obtain. Mr Z said:

> "Source *of finance is crucial for the normal operation of projects, a good source of finance will allow a company to have the confidence to explore the overseas market"*.

Professor AE noted:

> "*Nobody would allow an organisation to undertake international projects if they didn't know you had the resources*".

Several interviewees mentioned that a company was required to have a reliable source of finance in order to ensure that the enterprise's funds were sufficient and reasonable for the operation, and to ensure the project operation's success. Mr S noted:

> *"In recent years, with the increasingly fierce competition in the construction market, cash-strapped and currency management problems have been exposed, which have seriously restricted construction enterprises' survival and development. Thus, it is necessary for a company to have a good source of funds".*

Mr B explained:

> *"Source of finance is important for international business. Where is the money coming from? Bank, shares or funds? What is the company's ability to repay this money? Overseas investors and clients want to know your company's ability to repay debts. They would not cooperate with you or allow you to enter their market if they did not understand your financial position".*

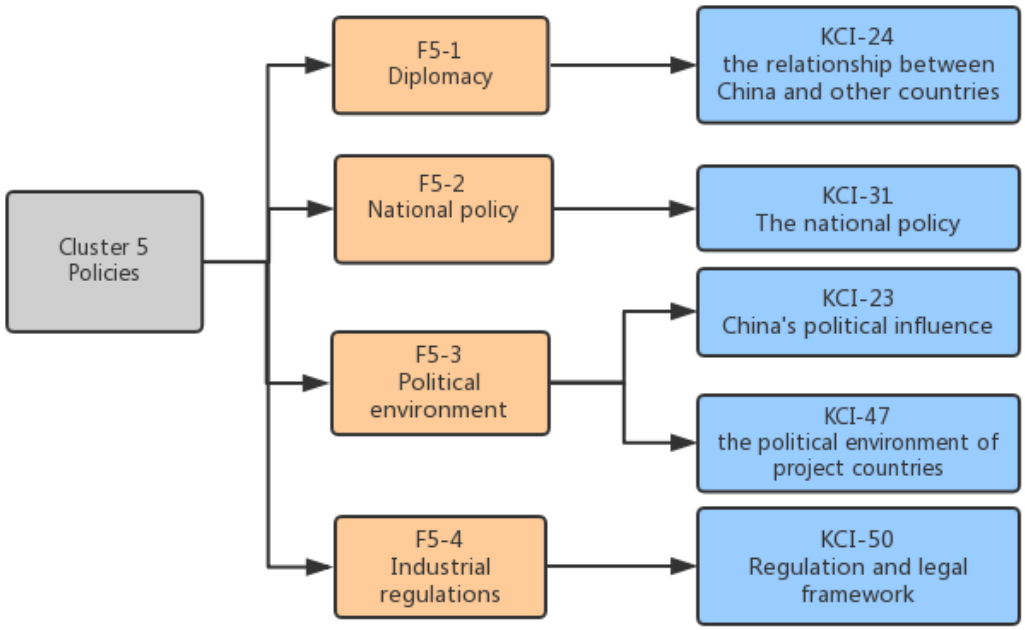
6.2.5 Cluster five: Policies

Ofori (2006) suggested that the ability to deal with political issues was a requirement for success in international construction because of the multiplicity of nationalities involved.

Respondents in interviews proposed five KCIs relevant to policy. Many interviewees considered that it was necessary to consider political issues when analysing CCFs' international competitiveness, because Chinese policies provided many opportunities for CCFs to explore the global market. The political KCIs identified were: KCI-24 the relationship between China and other countries, KCI-31 National policy, KCI-23 China's political influence, KCI-50 regulations and legal frameworks, and KCI-47 the political environment of project countries.

Those five KCIs have been classified into four factors (Figure 6.5): national policy, diplomacy, industrial regulations, and the political environment.

Figure 6. 5: Cluster of policies



Source: Author (2017)

6.2.5.1 Factor of national policy

KCI-31 National policy

The Chinese government developed a set of strategies and policies to support Chinese enterprises to "go out". For example, the 21st century Maritime Silk Road and the Silk Road Economic zone, which promoted Chinese enterprises wishing to enter into the global market. Those policies were very important for domestic enterprises to "go out", because Chinese enterprises needed a good bilateral political environment with overseas countries. If the countries had policy barriers preventing foreign enterprises to enter, Chinese enterprises could face many difficulties when attempting to enter those countries. So, it was important for the Chinese government to initiate the Silk Road policy. One reason was to promote Chinese enterprises abroad; the other reason was to provide more tax for local governments, more job opportunities for local people and to support growth in the local economy. Therefore, the national policy considered it important for Chinese enterprises to expand in overseas markets, also, it was important for the two countries' cooperation (Long 2014). More and more Chinese enterprises began "to go out" in accordance

with China's "One Belt One road" initiative. In Saudi Arabia, Chinese construction firms have been involved in a number of areas, especially in the construction and communications sectors. From the statistics, 160 Chinese companies in Saudi Arabia established branches, and 175 China enterprises undertook projects in Saudi Arabia (Zhang 2017).

Mr R said:

> *"Policy support is very important. For example," One Belt One Road" policy enables large Chinese contractors undertake overseas projects. The national policy is a directive to tell us that what we can do".*

Mr L noted:

> *"The national policy is a strong force for Chinese construction enterprises wishing to enter the international market. This is a significant difference between Chinese and other countries' construction firms. The "One Belt One Road" policy provides more business opportunities for Chinese enterprises; moreover, CCFs could enhance their management ability and improve their international competitiveness in the international process; which would help CCFs become truly global competitive enterprises".*

In order to support Chinese enterprises wishing to go out, the Chinese government has published many political support documents, such as the promotion of national banks to provide financial support, encouraging lower bank lending rates, and decreasing export tax rebates. These policies have established favourable conditions for Chinese construction enterprises going out. Because of government support, Chinese construction enterprises could provide a competitive source of finance and international owners favour Chinese construction enterprises (Yuan 2011).

Mr N said:

> *"In order to promote CCFs going out, the Chinese government has set up some special funds and multiple financial institutions, commercial financial institutions also support loans for overseas projects. These national policies enable CCFs to develop new markets".*

Chinese President Xi Jinping proposed the "Ten Cooperation Programme" at the China-Africa Cooperation Forum, which included infrastructure construction. China would strengthen cooperation with Africa in infrastructure planning, design, construction, operation, and maintenance. The Chinese government has supported CCFs to actively participate in African infrastructure construction, such as: railways, highways, regional aviation, ports, electricity, and telecommunications. Additionally, in order to ensure the smooth implementation of the "Ten Cooperation Programme", China decided to provide a total of US $60 billion of financial support,

including US $5 billion dollars in free aid and interest-free loans, US $ 35 billion in preferential loans and export credit (Chinanews 2015).

In China, construction enterprises were highly dependent on government policy, not only because the government's policy adjustments could make a huge impact on the scale of investment in the construction industry, but also because government was an important investor and consumer in the construction industry. Therefore, it was important for Chinese construction companies to analyse and judge government policy (Zhu and Dong 1997).

However, Mr S stated:

> *"No doubt about it the national policy is important for CCFs entry into the global market. National policy supports international opportunities for CCFs, but how to obtain the project, and occupy the market is mainly based on the corporation's operational capability".*

6.2.5.2 Factor of diplomacy

KCI-24 The relationship between China and other countries

Since the 1950's, the Chinese government has established a bilateral relationship with developing countries through aid projects (Low and Jiang 2003). For example, on 18th November 2016, Chinese President Xi Jinping visited Ecuador. This visit was a significant event in the development of bilateral relations. The promotion of bilateral relations would contribute to mutually beneficial cooperation between the two countries to achieve greater bilateral development. Fernando Yepes, the Deputy Foreign Minister of Ecuador, said that China was a trusted friend of Ecuador and a strategic partner for equality and mutual benefit. In the eyes of the Ecuadorian people, China was a fraternal and friendly country and the friendship between the two countries was deeply rooted. In particular, China has played an irreplaceable role in the construction of major projects in Ecuador. Many of the major projects, relating to the development of Ecuador's economy, have been undertaken by Chinese-funded enterprises and have become landmark projects of cooperation between the two countries (Li 2016).

Mr B stated:

> *"The harmony and friendship between China and other countries is very important, because Chinese construction firms undertake many aid projects overseas based on the nations' bilateral trade. Thus, the relationship between China and other countries is an opportunity for us to enter the international market. Moreover, I think other countries' construction companies mainly rely on their own ability to enter the global market, not on*

national relationships, so I think this is Chinese construction firms' unique competitiveness".

Mr AA noted:

"China has enjoyed a good political relationship with African countries for 60 years, so Chinese construction firms always have opportunities to undertake African projects. At present, China has started to build up relationships with East European and Latin American countries, such as Poland, Hungary and Brazil, so the Chinese have been involved in more and more infrastructure projects in these countries".

However, Mr T disagreed with other interviewees' opinions. He stated:

"The relationship between China and other countries supported a worthy policy background for Chinese construction firms' operations in the global market, but it was important to recognise that overseas projects mainly relied on construction companies' abilities, such as, project management, cost-effective and cultural communications with local people, not the political background".

6.2.5.3 Factor of industrial regulations

KCI-50 Regulations and legal frameworks

In the first round of interviews, Professor AE explained that:

"When entering a new market, it was necessary to understand its regulations and legal framework. An understanding of the context of these was essential in the new country."

A legal framework has been developed to guide reform in the construction industry. According to Shen *et al.* (2004), the legal framework related to construction could be described through eight major regulatory systems, such as, business licences and qualifications, quality monitoring, project supervision, tendering, qualification management, an initial capital system, contract administration, and owner responsibility. In China, there existed four laws, 18 administrative regulations, 86 department regulations and rules, and approximately 1200 local regulations and rules relating to the construction industry (Lu 2006). However, when Xue (2006) compared construction regulations between China and Iran, it was evident that the different regulations between two countries affected a project's operation. It was, particularly, important to understand, and to adapt to the local country's construction standards and specifications on projects.

Mr P stated:

> *"In contractual projects, it is indispensable and even crucial to understand the construction legal system of both the global market and the host country".*

Mr K illustrated the point:

> *"In the domestic market, China has its own construction standards and related norms in accordance with China's construction industry's development. These standards and norms have been adjusted with the construction industry's development. Thus, Chinese construction employees are required to study and to accept the latest standards. Additionally, Chinese construction employees needed to study to learn about international construction regulations. It was important to learn and accept local engineering, and technical standards, and norms".*

Mr V expressed the view:

> *"As a construction firm, we need to achieve mutual acceptance of a project's technical standards and norms with project owners in negotiations, it is the basis of a project's management work. We cannot blindly transfer our existing domestic standards and specifications to project countries. More importantly, it is necessary to learn, accept and adapt to local standards and norms. Additionally, trying to discover the differences and gaps between two countries' standards was important in order to propose the appropriate construction standards which would allow both countries to recognise".*

Furthermore, Yuan (2011) noted that it was necessary to actively promote China's construction standards. China's construction enterprises were required actively to participate in the formulation and promotion of international construction regulations, in order to fall in line with the global construction market. Moreover, it was important to develop China's construction regulations in developing countries in order to promote China's standards and enhance the CCFs' competitiveness.

6.2.5.4 Factor of political environment

KCI-23 China's political influence

China's international image and status provided reliable trust for Chinese construction enterprises to participate in a host country's construction market (Yuan 2011).

Mr L said:

> *"I rated it is very important, because China's political influence influenced where we could operate, and who were our partners. A strong country behind us has made us feel confident to operate projects overseas. The Chinese have been undertaking more and more international projects in conjunction with the promotion of China's political influence in the world".*

Ms W noted:

> *"One example is that when the Asian Infrastructure Investment Bank was promoted by China, many countries responded by wishing to join this bank, this shows China has influence in the world; and this bank supports Chinese construction firms to obtain financing to undertake international projects. So, I think China's political influence is an indirect indicator for Chinese competition in global markets".*

China's rapid economic growth has made China become the second largest economy in the world. A weak economy represented a country without diplomacy. A country with a weak economy could not support its enterprises' large-scale overseas investment and trade. Therefore, China's increased global competitiveness provided a basic political condition for Chinese enterprises abroad. Global investors or other countries were willing to cooperate with a foreign enterprise which was from a strong economy. So, global investors and foreign countries trusted Chinese enterprises. The national economy was a very important factor for Chinese enterprises' international business (Long 2014).

KCI-47 The political environment of project countries

Many respondents mentioned that the project countries' political environment could affect CCFs' risks in a project's operation, especially the risks of employees' safety and cost control.

Mr F noted:

> *"The political environment risk is the main risk for international construction companies. The changing global situation, and a project country's political, social unrest, riots and terrorism, will affect a project's operation".*

Mr E illustrated the point:

> *"In 2011, Chinese projects in Libya had to pause because of the outbreak of war. A total of 75 CCFs' investment and construction projects lost profits in Libya, which involved the contract value of US $18.8 billion. Moreover, the Libyan Sahara bank sent an advance payment guarantee letter to Chinese enterprises that necessitated each CCF paying*

around $100 million dollars. Thus, the political and social environment were very important for a project".

Mr T stated:

"Projects in all countries must face the political environment. However, this does not mean that the political environment risk cannot be avoided. CCFs could find a way to seek an appropriate method to adapt to the political environment, and, thereby, avert political risk".

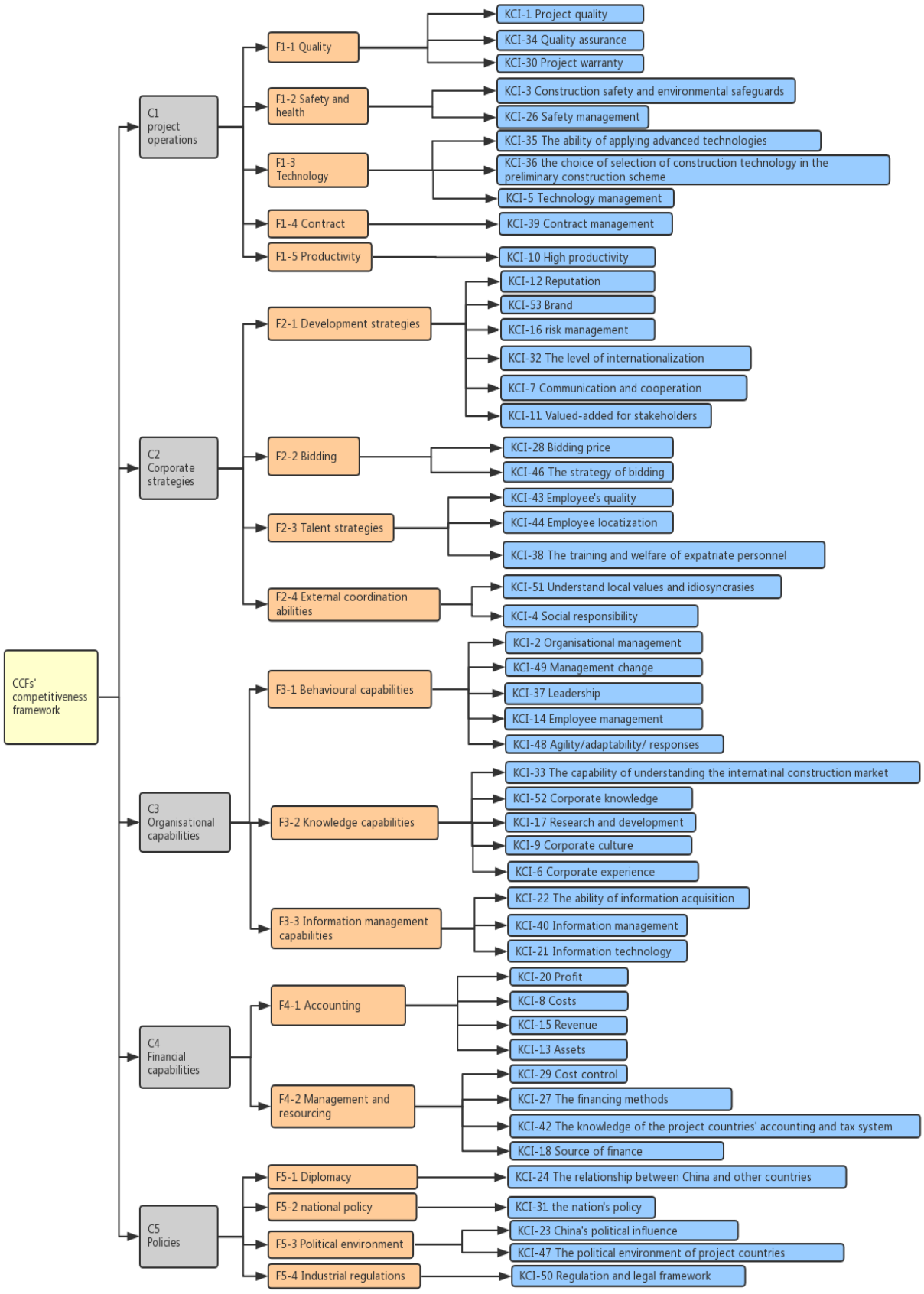
Mr Z said:

"CCFs face great political risks in project countries, especially, in developing countries. For example: Nationalism, protectionism, frequent changes of government, the vagaries of policy and laws, local separatist's attacks, race, religion, and cultural conflicts were problematic".

High fluctuations in the political environment could increase political risks in a country, which could affect the business environment of multinational enterprises, and thus could cause an enterprise to suffer huge economic losses. A steady political environment could guarantee legal rights and solid business development in multinational corporations, because the political environment could provide an assurance for multinational corporations. The business environment would be more stable and political risks lower if the country had a predictable political environment (Foreign Affairs Observer 2015).

This chapter concentrated mainly on qualitative factors that analysed the 49 KCIs' important reasons for CCFs based on the literature review and interviewees' responses. Additionally, the author tightened each cluster of KCIs into factors relating to the KCIs' meaning, for example, KCI-1 project quality, KCI-34 quality assurance, and KCI-30 project warranty were all related to project quality, so they were classified into the factor relating to quality. Thus, the competitiveness framework (Figure 5.1) could be developed in (Figure 6.6). The clusters were labelled to CX, for example, and cluster of project operations was labelled to C1, similar, clusters of corporate strategy, organisational capability, financial capability, and policy were labelled to C2, C3, C4, and C5. Furthermore, the factors have been labelled to FX-Y, for instance, the factor of quality was in the cluster of project operation, so it was labelled to F1-1; the factor of development strategies was in the cluster of C2 corporate strategy, so it was labelled to F2-1. Labels of these clusters, factors and KCIs facilitated the writing of their names into a mathematical formula for calculating a construction firm's competitiveness in the next chapter.

Figure 6. 6: CCFs' competitiveness framework



Source: Author (2017)

6.3 Summary

The two aims of this chapter have been achieved: to understand the sense of each cluster and the clarification of KCIs, and tightening of the refining competitiveness framework by reference to the literature review and interviews results. The competitiveness framework (Figure 5.1) was tightened through an analysis of secondary and primary qualitative data. Five clusters were classified in the competitiveness framework: project operation, corporate strategy, organisational capability, financial capability, and policy. 49 KCIs were categorised into different factors in each cluster based on their meaning (Figure 6.6). This was different from the draft conceptual competitiveness framework (Figure 4.8), in which was established in the secondary literature review that had three clusters: corporate strategy, organisational capability, and financial capability.

It can be seen that gaps appeared between the secondary literature review and primary interviews data. First, the literature review overlooked both the project operation and policy that constituted the main aspects of competition at a firm's level. A project was a major source of competitiveness for construction firms' production (Gao *et al*. 2013). Policy could be viewed as the macro condition of an enterprise's development, especially, since China publishes policies concerning infrastructure development in order to increase national economic influence, and to strengthen the bilateral relationship with other countries. A comparison between Western countries' governance philosophy: liberal peace, which emphasised free markets, and the protection of human rights. Whereas Chinese-style peace concentrated on economic development based on improving infrastructure, reducing poverty, and stabilizing governance (Kuo *et al.* 2012). Therefore, it was necessary to analyse policy issues when identifying CCFs' international competitiveness. Secondly, in the literature review, the three competitiveness schools have illustrated many indicators, which contributed to a firm's competitiveness, such as quality, organisation management, corporate culture, risk management and costs. The Modified Delphi interviews confirmed these indicators were important for CCFs. However, as section 3.3 mentioned, the three competitiveness theory schools lacked identifying the indicators related to marketing responding ability, macro resource, and agility and adaptability. However, the Modified Delphi interview results showed that KCI-51 understanding local values and idiosyncrasies, KCI-49 management change, KCI-48 agility/adaptability/responses, KCI-33 the capability of understanding the international market, KCI-22 the ability of information acquisition, and the KCIs regarding policy were key indicators for CCFs' international competitiveness. Therefore, this research extended knowledge of competitiveness for the three schools' concepts.

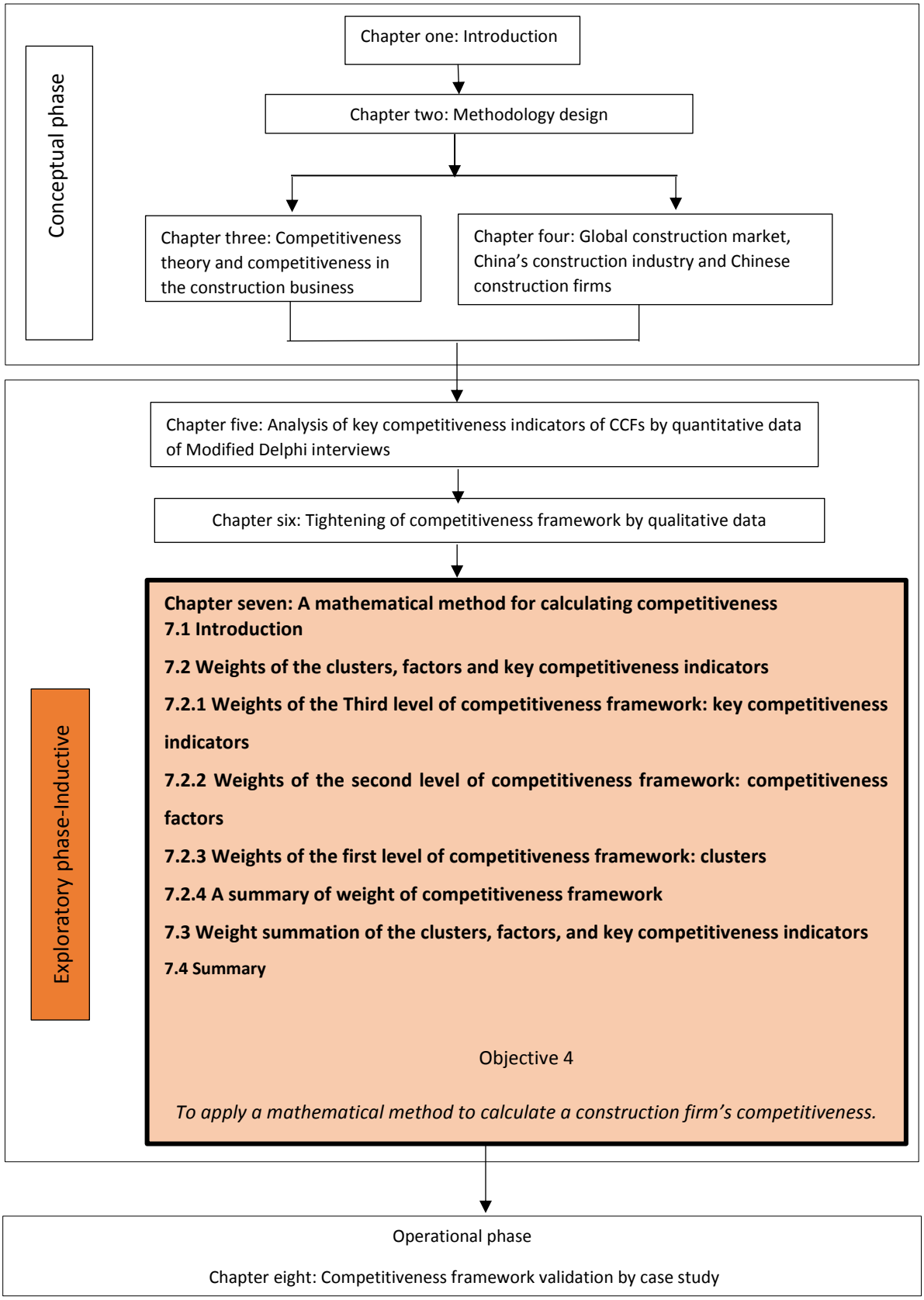
Cluster one of project operation enabled CCFs to improve their projects' performances relating to quality, safety, technology, contracts and construction team management, ensuring CCFs'

projects had competitiveness and to achieve trust in the global market. Cluster two of corporate strategy supported an understanding of how to engage in international business for CCFs. Cluster three of organisational capability helped CCFs review gaps concerning organisational capability at the international level. Cluster four of financial capability was of benefit to CCFs' evaluation of their financial ability in global projects' investment. Cluster five of policy facilitated CCFs understanding of the macroscopic policy environment which related to their international business, in order to make appropriate business expanding strategies or risk avoiding strategies.

In the next chapter, a firm's competitiveness will be identified by using an appropriate mathematical method calculation based on the CCFs' competitiveness framework (Figure 6.6) and the quantitative data relating to interviews results.

Chapter Seven

Calculating Chinese construction firms' competitiveness



7.1 Introduction

Last chapter analysed the Key Competitiveness Indicators (KCIs)' important considerations based on the respondents' answers and the secondary literature review, and the competitiveness framework was established in Figure 6.6. In this chapter, a mathematical method for calculating competitiveness is considered. The model for calculating the contractor competitiveness index has been delineated by combining a formula, and a graphic approach. In general, the model has been developed mainly by incorporating a method referred to as "Weighted Summation" (Lu 2006). In selecting an appropriate method, it was decided that it should not give rise to heavy computation, and complex algorithms in the assessment exercise. To meet this requirement, Weighted Summation, which is seen as one of the simplest multi-criteria evaluation methods, was frequently adopted to assess an organisation's competitiveness on the practical side (IMD 2004). Owing to Weighted Summation's simplicity, and it being widely recognized in practice, it was decided in this chapter to adopt the weighted summation method to calculate the competitiveness index of Chinese construction firms. The specific procedures have been detailed in the following sections.

7.2 Weights of the clusters, factors and key competitiveness indicators

One assumption in the competitiveness framework was that multiple indicators measured a firm's competitiveness, and each indicator made a different contribution to or had a relative weight in the overall competitiveness of a given firm (Lu 2006). Shen *et al.* (2003) assumed that six attributes had a shared contribution to a construction firms' competitiveness. Thus, the weight of each attribute was equally 1/6. A similar approach has also been adopted by the World Competitiveness Yearbook (IMD 2004) where there was an assumption that their 20 competitiveness indicators had the same weighting in assessing national competitiveness. Each indicator had a weight of 1/20. However, it allocated unequal weights according to the status of the nations being assessed (Lu 2006).

The weights of competitiveness indicators in this research can be derived from the interview results in chapters five and six. The interviews adopted a five-point Likert scale to indicate the absolute important level of an indicator in terms of its contribution to CCFs' international competitiveness. The absolute importance can be seen from the "total value" as shown in Table 5.8. The absolute importance then can be transformed to the relative weight for each key competitiveness indicator (KCIs). This transformation allowed for calculating competitiveness by applying the Equation 7.1. The method for calculating the relative weights in this study can be described through the following expression:

$$W(xi) = \frac{TV(xi)}{\sum TV} \quad \text{(Equation 7.1)}$$

Where the xi was the parameter i, such as factor F1-1 or key competitiveness indicators KCI-1, the $TV\ (xi)$ was the total value of parameters selected by respondents. The $\sum TV$ was the sum of the total value of factors that were falling in the same group as xi. By applying the Equation 7.1, the relative weights of different levels of indicators could be calculated.

7.2.1 Weights of the third level of competitiveness framework: key competitiveness indicators

The weights of the third level in the competitiveness framework which were also referred to as key competitiveness indicators, could be calculated based on the interview results shown in Table 5.7 and the Equation 7.1. For example, in KCI-3 Construction safety and environmental safeguards, the total value was 157. There was another KCI-26 Safety management with a total value of 151 falling into the same factor of safety and health. Therefore, the equation may be depicted as:

$$W(KCI-3)=\frac{TV(KCI-3)}{\sum TV}=\frac{TV(KCI-3)}{TV(KCI-3)+TV\ (KCI-26)}=\frac{157}{157+151}=0.510$$

Similarly, the relative weights of other weights of KCIs could be calculated and tabulated, see Table 7.1.

Table 7. 1: Weights of the key competitiveness indicators

Clusters	**Factors**	**KCIs**	KCIs' total value	KCIs' weighting scores
Project operation	Quality	KCI-1 Project quality	158	0.357
		KCI-34 Quality assurance	153	0.345
		KCI-30 Project warranty	132	0.298
	Safety and health	KCI-3 Construction safety and environmental safeguards	157	0.510
		KCI-26 Safety management	151	0.490
	Technology	KCI-35 The ability to apply advanced technologies	154	0.337
		KCI-36 the choice of selection of construction technology in the preliminary construction scheme	152	0.333
		KCI-5 Technology management	151	0.330
	Contract	KCI-39 Contract management	156	1
	Productivity	KCI-10 High productivity	136	1
Corporate strategies	Development strategies	KCI-12 Reputation	155	0.188
		KCI-53 Brand	155	0.188
		KCI-16 Risk management	131	0.158
		KCI-32 The level of internationalisation	131	0.158
		KCI-7 Communication and cooperation	130	0.157
		KCI-11 Valued-added for stakeholders	125	0.151
	Bidding	KCI-28 Bidding price	153	0.502

		KCI-46 The strategy of bidding	152	0.498
	Talent strategies	KCI-43 Employees' quality	134	0.344
		KCI-44 Employee localisation	128	0.328
		KCI-38 The training and welfare of expatriate personnel	128	0.328
	External coordination ability	KCI-51 Understanding local values and idiosyncrasies	129	0.508
		KCI-4 Social responsibility	125	0.492
Organisation capabilities	Behavioural capability	KCI-2 Organisational management	154	0.220
		KCI-49 Management change	151	0.216
		KCI-37 Leadership	136	0.194
		KCI-14 Employee management	129	0.185
		KCI-48 Agility/adaptability/responses	129	0.185
	Knowledge capability	KCI-33 Understanding the international construction market	154	0.226
		KCI-52 Corporate knowledge	138	0.203
		KCI-17 Research and Development	133	0.195
		KCI-9 Corporate culture	129	0.190
		KCI-6 Corporate experience	127	0.186
	Information management capability	KCI-22 The ability of information acquisition	135	0.340
		KCI-40 Information management	135	0.340
		KCI-21 Information technology	127	0.320
Financial capabilities	Accounting	KCI-20 Profit	135	0.258
		KCI-8 Costs	132	0.252
		KCI-15 Revenue	129	0.246
		KCI-13 Assets	128	0.244
	Management and resourcing	KCI-29 Cost control	134	0.258
		KCI-27 Financing methods	131	0.252
		KCI-42 Knowledge of the project countries' accounting and tax systems	128	0.246
		KCI-18 Source of finance	127	0.244
Policies	Diplomacy	KCI-24 The relationship between China and other countries	132	1
	National policy	KCI-31 National policy	131	1
	Political environment	KCI-23 China's political influence	129	0.504
		KCI-47 The political environment of project countries	127	0.496
	Industrial regulations	KCI-50 Regulations and legal frameworks	127	1

Source: Author (2017)

7.2.2 Weights of the second level of competitiveness framework: competitiveness factors

The weights of the second level in the competitiveness framework, which have also been referred to as competitiveness factors in this research, could be calculated based on the interview results

shown in Table 5.7 and Figure 6.6. Table 5.7 presented KCIs' total value, thus, the total value of a competitiveness factor could be calculated based on the KCIs, which fell into the category. For example, in Figure 6.6, F1-1 Quality had three KCIs, including KCI-1 Project quality, KCI-34 Quality assurance and KCI-30 Project warranty, their total values respectively were: 158, 153 and 132, so the total value of the F1-1 Quality was 443. According to Figure 6.6, there existed other factors: F1-2 Safety and health, F1-3 Technology, F1-4 Contract, and F1-5 Productivity, which were in the same cluster as F1-1 Quality. Their total values were: 278, 457, 156 and 136 respectively. Therefore, the weight of F1-1 Quality could be calculated as:

$$W(F1-1) = \frac{TV(F1-1)}{\sum TV}$$

$$= \frac{TV(F1-1)}{TV(F1-1) + TV\ (F1-2) + TV\ (F1-3) + TV\ (F1-4) + TV\ (F1-5)}$$

$$= \frac{443}{443 + 278 + 457 + 156 + 136} = 0.301$$

By applying a similar procedure, the weights of other factors could be calculated as shown in Table 7.2

Table 7. 2: Weights of the competitiveness factors

Clusters	**Factors**	**Factors' total value**	Factors' weighting scores	**KCIs**
Project operation	F1-1 Quality	443	0.301	KCI-1 Project quality
				KCI-34 Quality assurance
				KCI-30 Project warranty
	F1-2 Safety and health	278	0.189	KCI-3 Construction safety and environmental safeguards
				KCI-26 Safety management
	F1-3 Technology	457	0.311	KCI-35 The ability to apply advanced technologies
				KCI-36 the choice of selection of construction technology in the preliminary construction scheme
				KCI-5 Technology management
	Contract	156	0.106	KCI-39 Contract management
	Productivity	136	0.093	KCI-10 High productivity
Corporate strategies	Development strategies	827	0.466	KCI-12 Reputation
				KCI-53 Brand
				KCI-16 Risk management
				KCI-32 The level of internationalisation
				KCI-7 Communication and cooperation

				KCI-11 Valued-added for stakeholders
	Bidding	305	0.172	KCI-28 Bidding price
				KCI-46 The strategy of bidding
	Talent strategies	390	0.219	KCI-43 Employees' quality
				KCI-44 Employee localisation
				KCI-38 The training and welfare of expatriate personnel
	External coordination ability	254	0.143	KCI-51 Understanding local values and idiosyncrasies
				KCI-4 Social responsibility
Organisation capabilities	Behavioural capability	699	0.393	KCI-2 Organisational management
				KCI-49 Management change
				KCI-37 Leadership
				KCI-14 Employee management
				KCI-48 Agility/adaptability/responses
	Knowledge capability	681	0.383	KCI-33 Understanding the international construction market
				KCI-52 Corporate knowledge
				KCI-17 Research and Development
				KCI-9 Corporate culture
				KCI-6 Corporate experience
	Information management capability	397	0.224	KCI-22 The ability of information acquisition
				KCI-40 Information management
				KCI-21 Information technology
Financial capabilities	Accounting	524	0.502	KCI-20 Profit
				KCI-8 Costs
				KCI-15 Revenue
				KCI-13 Assets
	Management and resourcing	520	0.498	KCI-29 Cost control
				KCI-27 The financing methods
				KCI-42 Knowledge of the project countries' accounting and tax systems
				KCI-18 Source of finance
Policies	Diplomacy	132	0.204	KCI-24 The relationship between China and other countries
	National policy	131	0.203	KCI-31 National policy
	Political environment	256	0.396	KCI-23 China's political influence
				KCI-47 The political environment of project countries
	Industrial regulations	127	0.197	KCI-50 Regulations and legal frameworks

Source: Author (2017)

7.2.3 Weights of the first level of competitiveness framework: clusters

The total value of each cluster could be represented by the sum of the total value of the factors it contained. The weight of each cluster could be calculated based on the data in the Table 7.2 and the Equation 7.1. For example, the weights of cluster C1 Project Operation:

$$W(C1) = \frac{TV(C1)}{\sum TV} = \frac{TV(C1)}{TV(C1) + TV\ (C2) + TV\ (C3) + TV\ (C4) + TV\ (C5)}$$
$$= \frac{1470}{1470 + 1776 + 1777 + 1044 + 646} = 0.219$$

By adopting a similar procedure, the weights of other clusters could be calculated, as shown in Table 7.3.

Table 7. 3: Weights of the competitiveness clusters

Clusters	Clusters' total value	Clusters' weighting scores	Factors	KCIs
C1 Project operation	1470	0.219	F1-1 Quality	KCI-1 Project quality
				KCI-34 Quality assurance
				KCI-30 Project warranty
			Safety and health	KCI-3 Construction safety and environmental safeguards
				KCI-26 Safety management
			Technology	KCI-35 The ability to apply advanced technologies
				KCI-36 the choice of selection of construction technology in the preliminary construction scheme
				KCI-5 Technology management
			Contract	KCI-39 Contract management
			Productivity	KCI-10 High productivity
Corporate strategies	1776	0.264	Development strategies	KCI-12 Reputation
				KCI-53 Brand
				KCI-16 Risk management
				KCI-32 The level of internationalisation
				KCI-7 Communication and cooperation
				KCI-11 Valued-added for stakeholders
			Bidding	KCI-28 Bidding price
				KCI-46 The strategy of bidding
			Talent strategies	KCI-43 Employees' quality
				KCI-44 Employee localisation

				KCI-38 The training and welfare of expatriate personnel
			External coordination ability	KCI-51 Understanding local values and idiosyncrasies
				KCI-4 Social responsibility
Organisation capabilities	1777	0.265	Behavioural capability	KCI-2 Organisational management
				KCI-49 Management change
				KCI-37 Leadership
				KCI-14 Employee management
				KCI-48 Agility/adaptability/responses
			Knowledge capability	KCI-33 Understanding the international construction market
				KCI-52 Corporate knowledge
				KCI-17 Research and Development
				KCI-9 Corporate culture
				KCI-6 Corporate experience
			Information management capability	KCI-22 The ability of information acquisition
				KCI-40 Information management
				KCI-21 Information technology
Financial capabilities	1044	0.156	Accounting	KCI-20 Profit
				KCI-8 Costs
				KCI-15 Revenue
				KCI-13 Assets
			Management and resourcing	KCI-29 Cost control
				KCI-27 Financing methods
				KCI-42 Knowledge of the project countries' accounting and tax systems
				KCI-18 Source of finance
Policies	646	0.096	Diplomacy	KCI-24 The relationship between China and other countries
			National policy	KCI-31 National policy
			Political environment	KCI-23 China's political influence
				KCI-47 The political environment of project countries
			Industrial regulations	KCI-50 Regulations and legal frameworks

Source: Author (2017)

7.2.4 A summary of the weight of the competitiveness framework

The weights of clusters, factors and KCIs were calculated through a series of data processes. Table 7.4 has displayed the weighting scores of competitiveness parameters.

Table 7. 4: An inventory of the weights of competitiveness parameters

Clusters and weights		Factors and weights		KCIs and weights	
Project operation	0.219	Quality	0.301	KCI-1 Project quality	0.357
				KCI-34 Quality assurance	0.345
				KCI-30 Project warranty	0.298
		Safety and health	0.189	KCI-3 Construction safety and environmental safeguards	0.510
				KCI-26 Safety management	0.490
		Technology	0.311	KCI-35 The ability to apply advanced technologies	0.337
				KCI-36 the choice of selection of construction technology in the preliminary construction scheme	0.333
				KCI-5 Technology management	0.330
		Contract	0.106	KCI-39 Contract management	1
		Productivity	0.093	KCI-10 High productivity	1
Corporate strategies	0.264	Development strategies	0.466	KCI-12 Reputation	0.188
				KCI-53 Brand	0.188
				KCI-16 Risk management	0.158
				KCI-32 The level of internationalisation	0.158
				KCI-7 Communication and cooperation	0.157
				KCI-11 Valued-added for stakeholders	0.151
		Bidding	0.172	KCI-28 Bidding price	0.502
				KCI-46 The strategy of bidding	0.498
		Talent strategies	0.219	KCI-43 Employees' quality	0.344
				KCI-44 Employee localisation	0.328
				KCI-38 The training and welfare of expatriate personnel	0.328
		External coordination ability	0.143	KCI-51 Understanding local values and idiosyncrasies	0.508
				KCI-4 Social responsibility	0.492
Organisation capabilities	0.265	Behavioural capability	0.393	KCI-2 Organisational management	0.220
				KCI-49 Management change	0.216
				KCI-37 Leadership	0.194
				KCI-14 Employee management	0.185
				KCI-48 Agility/adaptability/responses	0.185
		Knowledge capability	0.383	KCI-33 Understanding the international construction market	0.226
				KCI-52 Corporate knowledge	0.203
				KCI-17 Research and Development	0.195
				KCI-9 Corporate culture	0.190
				KCI-6 Corporate experience	0.186
		Information management	0.224	KCI-22 The ability of information acquisition	0.340
				KCI-40 Information management	0.340

		capability		KCI-21 Information technology	0.320
Financial capabilities	0.156	Accounting	0.502	KCI-20 Profit	0.258
				KCI-8 Costs	0.252
				KCI-15 Revenue	0.246
				KCI-13 Assets	0.244
		Management and resourcing	0.498	KCI-29 Cost control	0.258
				KCI-27 Financing methods	0.252
				KCI-42 Knowledge of the project countries' accounting and tax systems	0.246
				KCI-18 Source of finance	0.244
Policies	0.096	Diplomacy	0.204	KCI-24 The relationship between China and other countries	1
		National policy	0.203	KCI-31 National policy	1
		Political environment	0.396	KCI-23 China's political influence	0.504
				KCI-47 The political environment of project countries	0.496
		Industrial regulations	0.197	KCI-50 Regulations and legal frameworks	1

7.3 Weight summation of the clusters, factors, and key competitiveness indicators

The weighted summation method could be described in the following equation:

$CV = \sum_{i=1}^{I} Wi * S(Ai)$ (Equation 7.2)

Where: CV was the competitiveness value of a parameter at a higher level. Ai (i=1…I) were the sub-parameters included in the higher level parameter, Wi (i=1…I) was the weight of indicators Ai (i=1…I), and S (Ai) (i=1…I) was the score value of Ai (i=1…I) (Hobbs and Merier 2000).

The procedures for calculating a firm's competitiveness can be understood by following a sequence form upper level to lower level ones. As shown in Figure 6.6, the competitiveness framework is derived from the five first-level parameters (competitiveness clusters) from C1 to C5. The procedures can be defined by the following formula based on Equation 7.2:

$$CV = \sum_{i=1}^{5} W(Ci) * S\,(Ci)$$

$$= W(C1) * S(C1) + W(C2) * S(C2) + W(C3) * V(C3) + W(C4) * V(C4) + W(C5) * V\,(C5)$$

$$= 0.219 * S(C1) + 0.264 * S(C2) + 0.265 * S(C3) + 0.156 * S(C4) + 0.096 * S(C5)$$

Where: CV was the competitiveness value of a given a construction firms; W (Ci) was the weight value of each cluster, which were calculated in Table 7.4, S (Ci) expressed the score value of each cluster.

The score value of each cluster (C1, C2, C3, C4, C5) will be calculated from the second level parameters (competitiveness factors). For example: as shown in the Figure X.XX, C1 Project

Operation had five factors, including F1-1 Quality, F1-2 Safety and health, F1-3 Technology, F1-4 Contract, F1-5 Productivity, with weight value were: 0.301, 0.189, 0.311, 0.106 and 0.093 respectively. Therefore, S (C1) can be defined by following the formula:

$$S(C1) = \sum_{i=1}^{5} W(F1-i) * S(F1-i)$$
$$= W(F1-1) * S(F1-1) + W(F1-2) * S(F1-2) + W(F1-3) * S(F1-3) + W(F1-4) * S(F1-4) + W(F1-5) * S(F1-5)$$
$$= 0.301 * S(F1-1) + 0.189 * S(F1-2) + 0.311 * S(F1-3) + 0.106 * S(F1-4) + 0{,}093 * S(F1-5)$$

Where S (C1) was the competitiveness score value of the cluster C1; W (F1-i) was the weight value of each factor in the cluster C1, S (F1-i) was the score value of each factor in the cluster C1.

By applying a similar calculation procedure to all of the other first level (clusters), the competitiveness scores of cluster C2 to C5 can be derived.

Again, the competitiveness scores of the second level (competitiveness factors) will be calculated from their KCIs, which were the third level competitiveness parameters. For example: F1-1 Quality, its competitiveness score of S (F1-1) can be calculated from its KCIs: KCI-1, KCI-34 and KCI-30, the formula can be shown as:

$$S(F1-1) = \sum_{i=1}^{3} W(KCI-i) * S(KCI-i) = W(KCI-1) * S(KCI-1) + W(KCI-34) * S(KCI-34) + W(KCI-30) * S(KCI-30) = 0.357 * S(KCI-1) + 0.345 * S(KCI-34) + 0.298 * S(KCI-30)$$

Where S (F1-1) is the competitiveness score of factor F1-1 quality; W (KCI-i) was the weight score of each KCIs in factor of quality, which is shown in Table 7.4; S(KCI-i) was the score of each KCI which could be rated by experts when assessing a construction firm's competitiveness.

By adopting a similar calculation procedure to all other the second level competitiveness factors, the competitiveness scores of competitiveness factors can be calculated.

7.4 Summary

This chapter has applied a mathematical method for calculating competitiveness by employing the competitiveness framework (Figure 6.6). The weight of each KCI, factors and clusters were calculated in Table 7.4. This has provided a direct weighting score calculated to assess a construction firm's competitiveness. The main procedures for calculating the competitiveness of a construction firm have been described. The procedure can be highlighted as:

(1) Collecting the rating data for the third level parameters (KCIs)

(2) Calculating competitiveness scores of the second level parameters (competitiveness factors)

(3) Calculating competitiveness scores of the first level parameters (competitiveness clusters)

(4) Calculating total competitiveness scores, which are the sum of the first level parameters

Based on the collecting rating data, competitiveness scores of the second level parameters (competitiveness factors) can be calculated, mainly by employing a weighted summation method. The weight of each KCI can be looked up in the weight directory (Table 7.4), which has been grounded from the context of interview results with 32 respondents. A mathematical description of the procedure has been illustrated in Equation 7.2.

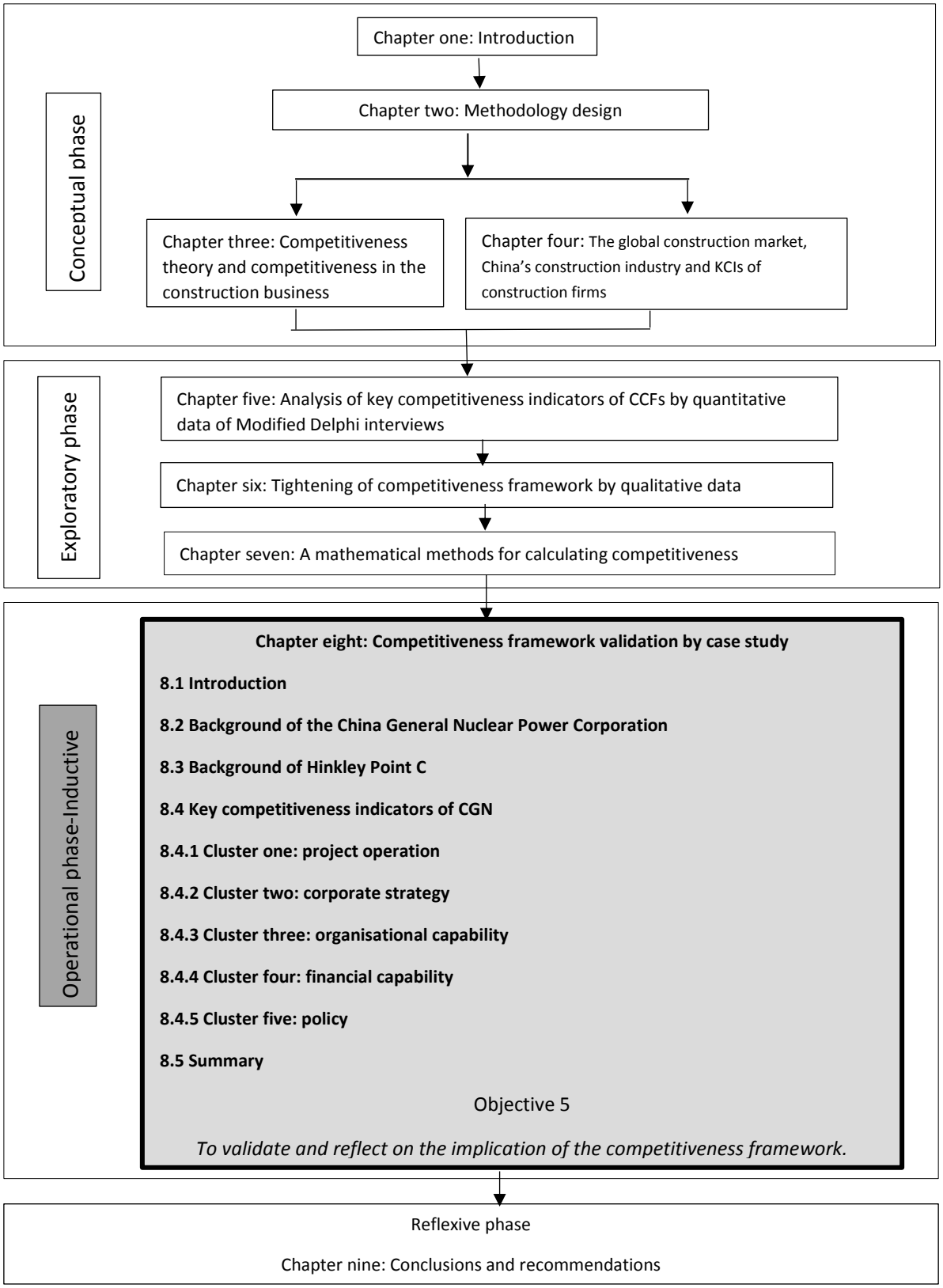
Similarly, the competitiveness scores of the first level parameters (competitiveness clusters) can be calculated based on the competitiveness scores of the second level parameters by using the weighted summation method. A mathematical description of the procedure can be seen in Equation 7.2.

Based on the competitiveness scores of the first level parameters, the overall competitiveness of a given construction firm can be assessed, again by applying a weight summation. The weights of the first level parameters have been developed and a mathematical description of the procedure can be found in Equation 7.2

In the next chapter, a case study will be carried out in order to test the practicability of the competitiveness framework, and to assess and calculate a Chinese construction firm's international competitiveness based on the framework by using the weighted summation method.

Chapter Eight

The international competitiveness of the China General Nuclear Power Group: Hinkley Point C: a case study



8.1 Introduction

In the previous chapters, the draft conceptual competitiveness (Figure 4.8) was generated from secondary literature reviews; it was refined and tightened by Modified Delphi interviews (Figure 6.6). Moreover, the weight scores of the 49 Key Competitiveness Indicators (KCIs) were calculated in order to estimate a construction firm's competitiveness. However, the competitiveness framework (Figure 6.6) required validation by challenging sectors in the construction market, which involved internationalisation, advanced engineering technologies, and high risks. Therefore, this chapter is concerned with China General Nuclear Power Corporation (CGN)'s operation at Hinkley Point C (HPC) power station in the UK as a case study, in order to:

1) Understand the Hinkley Point C's current issues
2) Validate the practicability of the competitiveness framework across a range of industries
3) Investigate CGN's international competitiveness based on the competitiveness framework

HPC was selected as a case study, because a nuclear power station was one sector of CCFs' international businesses, and was identified in chapter four; also competitiveness framework (Figure 6.6) indicated that a project's operation and policy were two important clusters, and HPC might be viewed as CGN's introduction to obtain a foothold in the UK, Thus, the application of the competitiveness framework (Figure 6.6) to CGN could provide an interesting case study to validate that .

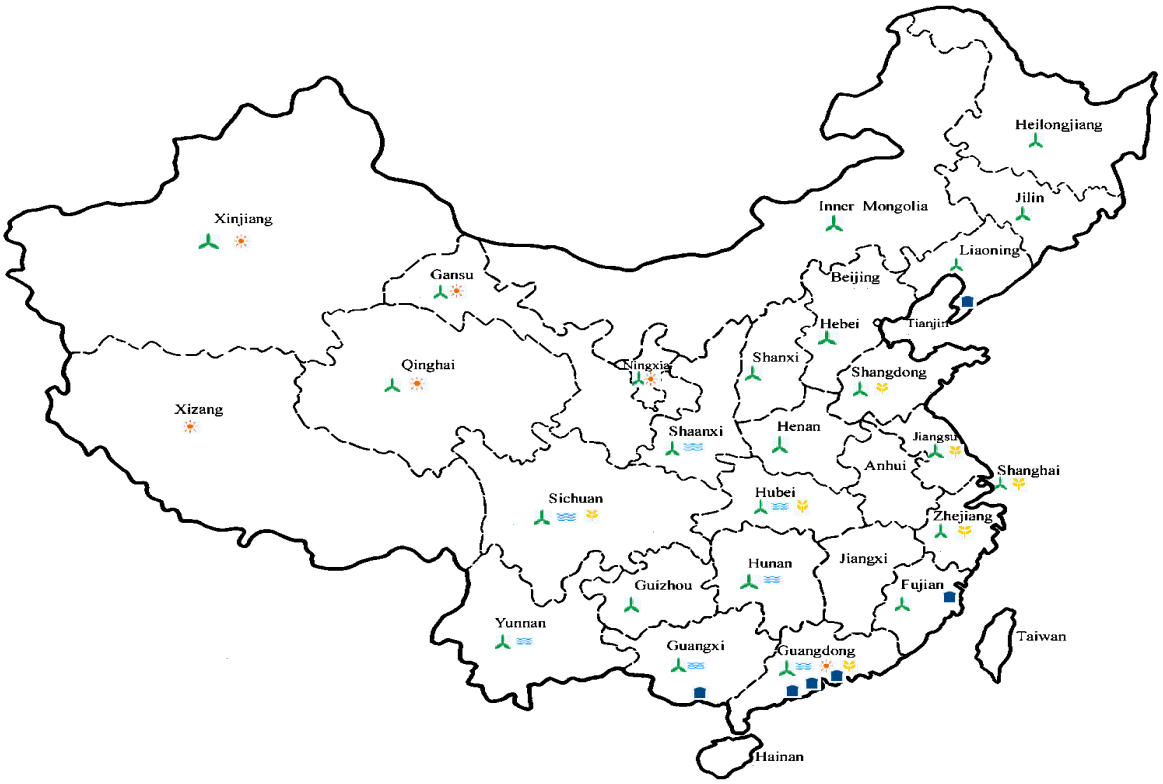
A case study cannot be viewed as a method in itself. Rather, it should be seen as a focus and the focus was on one isolated factor, looked at in depth, and from many angles (Thomas 2016). Stake (1995) made the point that a case study was the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances. The case study's evidence might include: documents, records, interviews, observations and physical artefacts (Gillham 2003; Yin 2014). In this case study, mainly documents and structured interviews have been supplied as evidence. Yin (2014) indicated that document data could include letters, web-based research, e-mails, agendas, proposals, reports, and news. Systematic searches for relevant documents were important for any data collection plan. This chapter mainly relied on documents from CGN's official website, news from the BBC, the Guardian, the Financial Times, the Telegraph and reports related to HPC. Additionally, Gillham (2003) considered that interviews were practicable and probably essential for individual case study. Structured interviews were conducted in order to obtain detailed opinions about CGN's competitiveness in HPC, and to examine the competitiveness framework's practicability position. As mentioned in section 2.4.2.2, in order to gain useful opinions related to this case, the sample of structured interviews based on

the following criteria: working experience in a nuclear power station; a management position or technical position, and rich knowledge of the UK and China's nuclear power construction market. Two experts were selected as interviewees, one was the technology manager in CGN, and the other one was a senior engineer in a British power station. As mentioned in 2.4.2.2, the nuclear power industry is a high technical, security conscious and sensitive industry, there were not too many experts involved, so a limited number of respondents was reasonable in this case. These two respondents applied good quality interview answers based on their professional knowledge and working experience.

8.2 Background of the China General Nuclear Power Corporation

China General Nuclear Power Corporation (CGN), its former name was China Guangdong Nuclear Power Corporation, a central clean energy enterprise in Shenzhen, Guangdong province, thereby, established to expand China's economic reforms, and promote the development of the nuclear power industry. CGN began its nuclear power station business when it undertook Guangdong Daya Bay Nuclear power plant construction in 1979. In 2013, the company was renamed the China General Nuclear Power Corporation with a registered capital amount of RMB ¥12.2 billion (CGN 2016). CGN has been listed on the Main Board of the Hong Kong Stock Exchange and was the only listed company in the world that solely operated nuclear power generation (CGN 2015b). Since its inception, CGN has evolved to become the largest nuclear operator in China, consisting of more than 40 subsidiaries and affiliates, and has employed 35,000 employees worldwide (CGN 2017a).

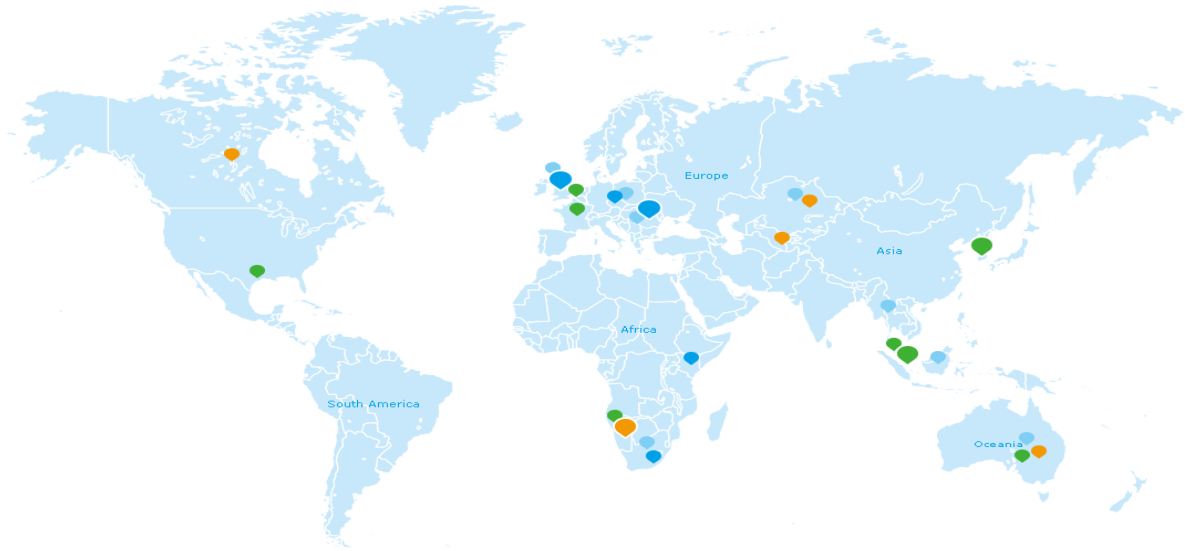
Figure 8. 1: CGN's domestic projects layout



Note: wind power; hydropower; solar energy; nuclear technology project; nuclear power project

Source: Author's compilation from CGN (2016)

Figure 8. 2: CGN's global projects layout



Note: Clean energy projects; nuclear power station projects; Uranium resourced projects

Source: Author's compilation from CGN (2017a)

Figure 8.1 and Figure 8.2 revealed that the company was an owner and operator of both nuclear power and renewable energy plants worldwide (CGN 2015a). CGN operated in industries, such as nuclear power, wind energy, solar energy, and hydroelectricity, and has made great advances in distributing energy, nuclear technology applications, and energy conservation technical services (CGN 2017a). Also, CGN provided customers with professional integrated energy solutions, including nuclear power plant designs, construction, operations, maintenance, and nuclear fuel supplies (CGN 2015a).

CGN (2017a) stated that it was continuously striving to fulfil its mission of "developing clean energy to benefit mankind"; to accomplish this goal, the company established research and development centres that supported its efforts to build, operate, and manage multiple nuclear and other clean energy projects, simultaneously, in different regions. By the end of 2016, CGN had 18 units in operation with a combined capacity of 19.3 gigawatts, equal to over 60 per cent of China's installed nuclear power or approximately a quarter of the UK's total installed capacity of all forms of power generation. Further, CGN had 10 units under construction with a combined capacity of 12.44 gigawatts, accounting for 20 per cent of worldwide nuclear new-build (He 2016).

8.3 Background of Hinkley Point C

In order to realise a low-carbon future, most nuclear projects have been placed in locations where there were already plants. The UK government has approved 10 sites in England and Wales for new nuclear power stations in 2009 (BBC 2009). Several further plants were at the planning stage as part of efforts to maintain energy security as the existing fleet of reactors was being phased out along with coal-fired power stations (Ward 2017). Hinkely Point C nuclear power station (HPC) was nominated as a potential site for a new nuclear power station (Figure 8.3). HPC was located in Somerest, England, was on course to be the first UK's new nuclear power station for two decades, and would be the biggest construction site in Europe (EDF 2015). HPC was a project incorporating two EPR reactors to generate 3,260 MWe of secure, low carbon electricity for around six million UK homes for 60 years. Construction at Hinkley would last eight years, and, if a target was met, would produce 7% of UK's electricity from its two reactors by 2025 (Farrell 2016).

Figure 8. 3: UK nuclear power stations and Hinkley Point C site map

Source: BBC (2008) and Wintour (2013)

In 2011, Electricite de France (EDF) applied for a nuclear site licence, and environmental permit applications. The Infrastructure Planning Commission granted these. In 2012, the site licence was granted which was the first to be awarded for a new power station in the UK for 25 years. In 2013, environmental permits were granted by the Environment Agency. In 2014, The European Commission approved agreements between the EDF Group and the UK government to build HPC. In 2015, Chancellor of the Exchequer, George Osborne announced a £2 billion infrastructure guarantee for HPC when he was on a five-day tour of China. In the same year, in the presence of the Chinese President, Xi Jingping, and the British Prime Minister, David Cameron, EDF and CGN signed a strategic investment agreement for the joint investment for two EPR reactors at HPC (EDF 2017). This proved to be China's initial participation in a nuclear power project in a developed country, which realised China's nuclear power ambition to enter Western countries and establish China's nuclear technology and equipment in the European market (Jiang 2016).

HPC was expected to cost £18 billion to build, most of which would be financed by EDF, and was 85% owned by the French state. There arose also doubts about the financial viability of the French firm EDF, EDF's market value has halved over the past two years and was now valued at

only €22bn (£18.7bn), not significantly more than HPC's entire investment. EDF also needed to invest €50bn over the next ten years to upgrade existing French reactors, and the French government wanted to end some state guarantees for EDF's revenues (Topping 2016). Thus, it prompted EDF's decision to co-operate with CGN to invest in HPC. CGN would cover 33.5% of the stake and would have to fund one-third of the £18 billion cost, in order to gain a foothold in Western Europe (Topping 2016). Once completed, HPC would deliver 7% of the UK's electricity, when most other nuclear power stations would have been closed down. The construction was expected to provide 25,000 jobs, while the finished power plant would employ 900 people (Moylan 2016). However, CGN's willingness to stump up the cash for Hinkely was dependent on a linked deal allowing China to manage the development of its own Hualong reactor technology at EDF's Bradwell site in Essex. China would take a two-third stake in the development, with EDF as the junior partner (Gosden 2016).

However, many local people have been against the development of HPC mainly from three aspects. First, critics considered that HPC was a bad deal for UK consumers because it was too expensive and would take too long to build (Ruddick 2016). EDF's contract with the government guaranteed the firm an initial price of £92.50 per megawatt hour for the electricity that HPC generated, more than double the market price now (Farrell 2016). If the wholesale price of power was lower than this set price, consumers would make up the difference. But the government now expected future wholesale electricity prices to be lower than forecasted when it agreed the initial price in 2013. The National Audit Office said that, as a result, the expected top-up payment by consumers has increased from £6.1 billion to £29.7 billion (Moylan 2016). The European Commission has also recently approved the UK's waste transfer contract scheme, which would apply to HPC. This innovative scheme has meant that the full cost of decommissioning and waste management associated with new nuclear power stations has been set aside during their generation and included in the price of electricity (EDF 2015). In addition, the UK's development cost of offshore wind power has reached a record low. Denmark's Dong Energy has been estimated at £57.50 per megawatt for its Hornsea project, and Spain's EDP with £57.50 per megawatt for the Moray wind farm (Vaughan 2017c). The new offshore wind farms would supply about 2% of the UK's electricity demand, with a net cost to consumers of under £5 per year, besides, the subsidies paid from a levy on consumer bills which would run for 15 years, would differ from HPC's subsidies which would run for 35 years (Harrabin 2017). But, Johnston (2016) considered that the UK still needed nuclear power stations to supply demand for electricity that could reach approximately 60,000 megawatts in the depths of winter.

Second, the UK government is worried about the nation's security if the Chinese operated the nuclear station. The government provoked uncertainty about the future of the nuclear industry

after it delayed giving final approval for HPC in July 2016. British Prime Minister Theresa May was said to have had concerns about Chinese involvement in such a sensitive project (Ruddick 2016). Davies (2016) was concerned that Theresa May's decision to put off approval for the nuclear power station has put the Chinese-British business relationship under tension.

Liu Xiaoming, Chinese ambassador in the UK, said that the UK could not have a better partner than the China General Nuclear Power Corporation. The latter was the biggest nuclear power provider in China. It was also the world's biggest builder of nuclear reactors, and has been involved in the construction of one-fifth of nuclear generators worldwide. This was a partner with world-class technology, the necessary financial resources and rich experience in the management and operation of nuclear plants. An important reason why this has been made possible was that both China and the UK have consistently respected and trusted each other. If Britain's openness was a condition for bilateral co-operation, then mutual trust was the very foundation on which this has been built (Liu 2016).

Third, during the operation of nuclear power stations, the effect on the environment was mainly the emission of radioactive waste. HPC would be a 3.2GW station, so the amount of radioactivity in the spent fuel from HPC in the year 2200 would be 3,800,000TBq – or about 80% of the radioactivity in existing waste (Nuclear Decommissioning Authority 2015).

CGN would make efforts to minimize the production of radioactive waste, practically to implement the principle of "As Low as Reasonably Achievable", and to undertake the management of radioactive waste, and, continuously, to enhance the controlling and processing technology in respect of radioactive waste. CGN has had good experience in managing radioactive waste, in 2015, CGN's total emissions were far lower than the national emission standards in China (CGN 2015b).

CGN (2015b) noted that local people and government should not worry about radioactive waste. CGN explained that pursuant to national policies and international practices, the spent fuels generated by nuclear power plant reactors would be kept in storage pools for a number of years, and then would be delivered to authorized service providers for reprocessing. CGN claimed to have conducted extensive research on processing techniques of high-level radioactive waste for decades. After assessing and comparing various approaches, deep geological disposal had become the best choice, that meant keeping high-level radioactive waste in special disposal repositories underground at hundreds of metres deep. CGN continuously has improved its environmental monitoring system, and environmental inspection, and record systems, and has successfully developed the KRS system (Environmental Radiation Monitoring System of Nuclear Power Stations), which was CGN's own intellectual property to provide more accurate and

reliable monitoring. Assessing the environment at and around nuclear power stations, a timely release of key ambient monitoring data has been proposed through a web portal of each station, and was open to the supervision by society and the public has been accepted.

8.4 Key competitiveness indicators of CGN

This section has applied the competitiveness framework (Figure 6.6) to investigate CGN's international competitiveness based on its operation at HPC. The competitiveness framework contained five clusters: the clusters of the project's operation, business strategies, organisational capabilities, financial capabilities, and policies. Each cluster possessed different factors and KCIs.

8.4.1 Cluster one: Project operations

This cluster investigated the capability of CGN in the project operation at HPC. CGN has not been involved in HPC's construction operation, but its ability in the project's operation could still be identified from the secondary literature review and the interviews. CGN would operate a further nuclear power station in the UK, thus, it was important to analyse CGN's project operation at HPC.

In chapter six, ten KCIs were divided into cluster one of the project's operations. These KCIs were related to five factors that included quality, safety and health, technology, contract, and productivity (Figure 6.2).

8.4.1.1 Factor of quality

KCI-1 Project quality

A problem faced by HPC, at present, was the carbon concentration in the steel. However, this would not prevent the start of HPC's reactor construction next year (Sage 2017). Nevertheless, Rivaz (2015) stated that all nuclear activities at HPC have been tested and monitored to meet stringent safety and quality requirements. This has been extended from design and construction to its operation.

Respondent AH said:

> *"If there is a problem in the carbon concentration, they should know about it, they should be aware before the start. Project quality is important, of course it is."*

Respondent Mr AG explained:

> *"Project quality is most important in a nuclear power station. We should lose money if quality has any problems. Project quality depends on a company's risk management ability, cost affordability and project design. For example, if one project was designed for use for a 100 years, project quality and construction materials will be limited if its construction materials could not ensure the project will be in use for a 100 years. But, if*

the materials cause worrying quality problems, it must revise its project, and change to other appropriate materials, otherwise, it will be necessary to invest more in finance to make up for any mistakes when the project is in use. We don't need to worry about HPC's quality with respect to the steel's carbon concentration issue, because EDF has designed the project using construction materials based on standards of quality assurance, we do every construction activity based on the UK's regulations, quality was controlled by the UK."

KCI-34 Quality assurance

The Nuclear Installation Act has been applied to HPC in order to control the project quality (Office for Nuclear Regulation 2012). But Sage (2017) considered that HPC's quality would not meet the requirement. Mr AG said:

"CGN has the ability to meet the standards of quality assurance. But in HPC, it mainly considers EDF's project assurance ability, CGN is one of shareholders, we are not involved in construction management. But EDF and CGN have been engaged in nuclear power stations for many years, we have this business experience and qualification, so the UK does not need to doubt our ability in quality assurance, we must carry out construction and the operation of HPC based on "The Nuclear Installation Act". Otherwise, the UK must not issue a construction permit to us."

KCI-30 Project warranty

Generally, construction firms were called upon to supply project warranties to investors and customers. The information from HPC's project warranty could not be identified from the secondary data. But the interviewees pointed out that it was important that EDF and CGN supplied a project warranty for HPC in order to ensure HPC's quality and safety after HPC transferred responsibility to the UK government.

Mr AG said:

"This project applied EDF's nuclear power technology, the UK lacks this technology, if when problems happen in the future, we must support related project warranty services."

Mr AH said:

"That is normally a partnership, if the initial firms come in to build it, you are still dealing with it 30 years later, so that could be perfect for providing a project warranty as normal."

8.4.1.2 Factor of safety and health

KCI-3 Construction safety and environmental safeguards

One of the key safety and environmental issues relating to a nuclear power station was radioactive waste. EDF and CGN had a set of comprehensive radioactive waste management mechanisms and environmental monitoring systems. However, local people were still concerned about radioactive pollution that could affect HPC's surrounding environment. The details of CGN's construction safety and environmental safeguards in HPC could not be researched at present, because EDF was the key contractor at HPC (Gao 2017). Both respondents reflected that radioactive waste was not a serious issue that needed to be considered.

Mr AH said:

> *"Similarly, this project… people who make the most noise do not understand what it is anyway, so, people keep screaming about radioactive waste. I do not think it could be possible to be radioactive. Do I think it is good effect concerning safety or not? I do not think so. I do not think it is something which needs to be concerned about, because they do not understand it."*

Mr AG explained:

> *"These issues are just like walking and driving, any unknown risks could be happening when you are in walking and driving. We understand local people's concerns, but we cannot stop developing nuclear power just because people are worried about safety and environmental pollution. We designed, constructed and controlled HPC's construction safety and environment safeguards to abide by the UK's regulations and laws. Not project is absolutely safe; we cannot overly change our construction plans and progress to meet the local people's pursuit of safety. Construction and radioactive waste management in this project must abide by international nuclear power safety regulations. The British do not need to worry too much about the radioactive waste management."*

CGN's previous nuclear power station projects could demonstrate that it had a good reputation to build safe and healthy environments. For example: Daya Bay's Nuclear power station, from long-term tracking and monitoring data of 10 monitoring stations within a radius of 10km of the base area, the surrounding area's environmental radioactivity had not changed since the nuclear power station began its operation, and the biological population of land and sea in this region had not changed either over the past 22 years (CGN 2016).

KCI-26 Safety management

EDF's EPR reactors had encountered a safety problem at Flamanville in France, a fan in the turbine hall caused an explosion and fire on 9th Feb 2017, causing five people to be treated for smoke inhalation (Gosden and Sage 2017). However, Daya Bay was CGN's first nuclear power station, which opened in 1994, has been internationally recognised as having one of the best safety records in the world, and CGN has never encountered safety problems with its nuclear power projects (He 2016). CGN's industrial safety accident rate per 200,000 hours worked has remained at a level as low as 0.014, which has been regarded as outstanding by global standards. Additionally, CGN held the world record of 4,372 continuous days of operation without any unplanned shutdown (CGN 2015a). Now, EDF and CGN together have undertaken HPC. CGN (2017a) said that nuclear safety was paramount as their baseline for HPC. EDF (2017) has said that safety in HPC was of the utmost importance to both EDF and CGN. Safety fears and doubts about nuclear projects were justifiable, and any problems would involve huge costs, which could wipe out orders for Chinese reactors. For example, Philippe Jamet, a French nuclear safety commissioner, said in 2014: "…unfortunately, collaboration with China is not at a level where we would wish it to be; one of the explanations for the difficulties in our relations is that the Chinese safety authorities lack means. They are overwhelmed" (Thomas 2016).

Respondent Mr AH considered:

> *"A national policy is a governmental organisation, they control safety as much as they can, but views on safety management are not the same as what they do."*

However, Mr AG had different opinion, he said:

> *"Safety management is very important. This is same with the answers in relation to construction safety and environmental safeguards, we invest and operate this project to abide by international and the UK's safety regulations and laws, but we cannot overly pursue it."*

Rivaz (2015) pointed out that Britain's Office for Nuclear Regulations was one of the most robust independent nuclear regulators in the world. No one could operate in the UK without its approval. All nuclear activities were tested and monitored to meet stringent safety and quality requirements. This extended from design and construction to operation. The regulator examined the reactor designs rigorously, and EDF spent four years taking their EPR design through the Generic Design Assessment. CGN would only be allowed to proceed with their technology if it passed the same scrutiny. Moreover, CGN (2015b) noted that the development of nuclear safety

awareness depended on the participation of all staff members in the company and required them to make persistent efforts (Figure 8.4).

Figure 8. 4: CGN's nuclear safety management

Source: Author adapted from CGN (2015b)

Figure 8.4 illustrated that CGN enhanced the nuclear safety awareness attainments of all staff members and improved the overall nuclear safety level within projects by conducting a series of promotional and educational activities.

8.4.1.3 Factor of technology

KCI-35 The ability to apply advanced technologies

Because CGN took a 33.5% stake in HPC and a 20% interest at the planned EDF controlled Sizewell site, in return, EDF granted CGN a controlling stake in a third site at Bradwell B (ITA 2016), the latter being a project which would showcase CGN's own nuclear technology in the shape of the HPR 1000 reactor. It is known as Hualong One, and has already received design approval from China's nuclear regulator. It conformed to the world's latest and most advanced safety requirements. CGN submitted HPR 1000 technology to the UK's nuclear regulator for Generic Design Assessment approval in the UK. CGN was confident that the HPR 1000 would meet the

UK's stringent safety, security and design requirements (He 2016). HPR 1000 was Chinese Gen III nuclear power technology, with 1150 MW output, single reactor layout and double capacity; it was under construction in Fuqing and in Fangchenggang, in China (CGN 2015a). Establishing HPR 1000 in Bradwell B would be the first Chinese designed and built nuclear reactor in the West (ITA 2016). Mr AH noted it was important to the Chinese company to enter the UK market. Mr AG explained:

> *"First, technology is the primary productive force. Secondly, in my private opinion, the UK agreed for France and China to operate HPC, because the UK does not have the appropriate technology to undertake such a huge project. This is one way for China to export technology; this facilitates improving China's international influence. China's marketing, technology, and demands are different from the UK. CGN can apply our own nuclear power technology in the UK that could show Chinese construction firms' own advanced technologies in the nuclear power industry and display our ability to apply advanced technologies in the world."*

KCI-36 The choice of selection of construction technology in the preliminary construction scheme

A technology application scheme has been deemed an effective way to further construction management in HPC. Mr AG illustrated:

> *"On the one hand, all projects require selection of appropriate construction technology in each construction step, in order to ensure that construction proceeds smoothly. On the other hand, as HPC is located in the UK, we must select appropriate technology in the preliminary scheme, in order to ensure that the British understand what we do and can question how we do it. Additionally, any technology changes could happen in the construction process, we can feel free to face the unknown risks and changes if we make clear the technology selection at the beginning of the construction scheme."*

KCI-5 Technology management

A nuclear power station required excellent technology management ability to support its running, otherwise, a nuclear power station could not meet the demand requirement and could face safety problems if any technology failed. Mr AG said:

> *"Technology management is very important. CGN has the total ability to manage the technologies at HPC. This project is mainly constructed by EDF, so we do not have too much responsibility for technology management, but we have sent 30 technology experts in CGN to HPC to provide technical support. After one month, we will send more technology experts to EDF's headquarters in France; they will engage in HPC's technology*

design with EDF. In total, CGN will send around 60 technical experts to HPC. Anyway, we will pay attention to technology management and demonstrate our technology in the next project at Bradwell."

KCI-10 High productivity

Gosden and Sage (2017) pointed out that EDF promised to deliver power from HPC by the end of 2025, and would start up in 2027. Construction teams' high productivity could enhance the completion of their daily tasks, in order to avoid construction delay. But Mr AG said:

"It is important, but we cannot give up quality in pursuit of high productivity, and we cannot slow down productivity in order to pursue good quality, productivity and quality need to balance. Many reasons have caused this project delay since its approval. EDF has struggled with its own financing, and it has faced a review by the UK government, which has caused a one year delay. The construction firms at HPC are larger than firms in the UK, I trust that they have good productivity to finish their construction work."

Analysis of secondary literature and interviews showed that CGN had good ability with respect to project operation: quality, safety and health, technology, contract, and productivity. Although CGN would not be involved in HPC's project operation, its project operation ability was one of the important competitiveness advantages to undertaking further nuclear power stations in the UK.

8.4.2 Cluster two: Corporate strategies

13 KCIs fell into the corporate strategies cluster, those KCIs have been placed into four factors: development strategies, bidding strategies, talent strategies, and the ability to coordinate external factors (Figure 6.3).

8.4.2.1 Factor of development strategies

KCI-12 Reputation

CGN was China's biggest nuclear power operator, and the world's largest nuclear power construction company (He 2016). As of the end of May 2016, the in-service nuclear power authority installed capacity totalling 17.09 GW, accounting for 60% of the Chinese mainland, ranking first domestically, and entering the top five internationally (CGN 2016). CGN's reputation could be one of the reasons that the UK agreed to sanction CGN's investment in the HPC because of CGN's strong nuclear power station's operational ability. However, Mr AG did not agree:

"I don't think so, a nuclear power station depends on a company's operational capability, rather than its reputation. We can invest in HPC and undertake other nuclear power station projects because we have good technologies; these technologies build up our

reputation in the world. But this is no parity between reputation and technologies. The UK agreed to support our investment in HPC, and the application of our Hualong One reactor in the next project, because they trusted our nuclear power technologies and financial ability, not about our reputation."

KCI-53 Brand

Hualong One was researched and produced by CGN, and the China National Nuclear Corporation (CNNC), their aim was committed to the continued integration and development of Hualong One as an independent third generation nuclear power technology, with the unified management of the Hualong brand, intellectual property, and other related assets at home and abroad (World Nuclear Association (WNA) 2017). EDF and CGN have signed the Heads of Terms agreement, in principle, to undertake the regulatory approval (Generic Design Assessment), with the UK's nuclear safety regulator, with a UK's version of the third generation HPR1000 reactor referred to as Hualong One. HPR1000 will be based on CGN's Fangchenggang Plant Unit 3/4 in China, the reference plant for the UK's Hualong design. Under the terms of the agreement, a joint venture company would undertake and manage the Generic Design Assessment process (EDF 2015). However, two respondents had different opinions about this. Mr AH said:

"Do I think the brand is important? Yes, it is, it is important, just as one British Member of Parliament has said: the UK is not yet capable of doing anything else in the nuclear power industry."

But Mr AG considered:

"It is not important, this is the same idea as reputation indicators. A nuclear power station does not pay attention to brand; it pays attention to the technological strength in construction and operation. Hualong One is one of CGN's brands, but, actually, it is a technology. Is reputation and brand important? No. The important thing is the technology."

KCI-16 Risk management

HPC has faced many risks since it started to plan its construction project, such as cost overruns, time delays, and potential risks after Brexit, and project safety (Gosden and Sage 2017; Webster 2017; Ridley 2017). Rivaz (2015) noted that EDF and CGN would shoulder all the construction risks. However, CGN's main potential risk to HPC was political. When Theresa May took over as British Prime Minister, she was concerned about Chinese involvement in such a sensitive project. Security experts were worried the Chinese might build weaknesses into computer systems that would allow them to "shut down Britain's energy production at will" and argued against giving a

"hostile state" access to the UK's critical infrastructure (Ruddick 2016). Vincent de Rivaz (2015), CEO at EDF, argued that the control system at HPC followed the country's safety monitoring systems, and would not be associated with any external information system or the Internet. British nuclear regulatory authorities believed that HPC safety issues have been properly addressed, and have granted a nuclear power plant licence. Rivaz (2015) stated that all employees at the nuclear power plant, regardless of which country they came from, must be subjected to a rigorous vetting procedure. He Yu, CGN's CEO, said that there had been much comment, much of it baseless and inaccurate, about whether it was wise for the UK to allow a Chinese company to have a direct, and an important role in an industry as strategically important and sensitive as nuclear power. Nevertheless, CGN's only interest in entering the UK nuclear industry was to make an appropriate and fair return on its investment by providing safe, secure and reliable power to UK households and businesses (He 2016).

However, interviewees held different views. Mr AH noted:

> *"I think their risk management now is bloody awful, I could see that what I read it in the news, but it could be important."*

Mr AG expressed his opinion:

> *"In my individual view, I am not satisfied with CGN's risk management at HPC. CGN pays more attention to the current construction progress and to the investment return, but ignores some political risks. For example, Theresa May considered that China's investment could bring a security crisis for the UK's nuclear power industry. But CGN did not initiate to negotiate with the UK government, instead, the Chinese government negotiated with the UK. Moreover, CGN did not consider the risk associated with local people's public opinion. We did not do any advertising during the pre-construction period, because the British at local level do not have a clear understanding of nuclear power, and even advocate stopping HPC. This shows CGN and EDF's lack of risk management currently. Risk management should be very important, but I only rated it score one here, because they did not do a good job with it."*

<u>KCI-32 The level of internationalisation</u>

CGN would make its investment in the UK through its new company named General Nuclear International (CNI), which was launched in August 2015 (Company House 2017). However, the two interviewees had different opinions. Mr AH noted directly that it was important to go abroad.

But Mr AG considered:

> *"This issue needed to be considered from two aspects, one aspect is in its headquarters. Headquarters does not need to improve its internationalisation to meet the UK market requirements, because the UK is one of the markets for CGN, we have a lot of branch offices in China; we still need our Chinese style to manage them. But the brand in the UK must pay attention to internationalisation in organisational management, in order to adapt to the UK market."*

KCI-7 Communication and cooperation

He (2016), the chairman of CGN, explained that multinational collaboration on a nuclear station's construction, and operation was common practice in the nuclear power sector. A large number of nuclear plants in China were products of collaboration with France, Russia, Canada, the US, and the UK. CGN has been always been open to global collaboration with other nuclear players, and CGN, therefore, hoped that the UK would also embrace China with openness. CGN has had much to learn from EDF, as CGN was just beginning its nuclear journey in the UK. But it was to be hoped that the UK would also learn from CGN, as CGN would be importing not exporting – technology and know-how. Further, CGN will be helping to train a whole new generation of nuclear engineers through partnerships with UK universities. EDF established a community hub near HPC in order to share its news, and construction plans in order to communicate with people who were interested in HPC (EDF 2017). CGN (2017a) said that it was important to communicate with the public and other stakeholders, such as opinion leaders, staff, local people and organisations. However, there was no evidence to show that CGN had provided communication concerning HPC so far.

Mr AG considered:

> *"Communication and cooperation in HPC is mainly EDF's task, we are investors, so we are not engaged in it. But I think communication between company and the public is very important. Many local people do not have an understanding of nuclear power, they are afraid of nuclear waste, leaks and explosions, so it is necessary that we communicate with the public, to let them know that nuclear power is the safest and cleanest form of electricity. In the next project at Bradwell, I think CGN will do it."*

Mr AH stated:

> *"I do not think it is important that a construction firm communicates with the public. I do not believe what firms have said. Too long in this industry, it is known that what they say in public is not true. We obviously have to communicate with customers, but it depends on*

who you think customers are… I would like to think about the cost really when we try to build Fawley B here."

KCI-11 Valued-added for stakeholders

The UK government has approved 10 sites in England and Wales in order to realise a low-carbon, safe and cheap electrical energy supply (BBC 2009). CGN was highly committed to delivering safe, cost efficient, and sustainable energy, and to supporting the UK's goal of becoming a low-carbon society (EDF 2015). Additionally, the economic benefits of China's investment in the UK's new nuclear plants would be shared among businesses and workers across the country. HPC would make the biggest inward investment in British history.

But Mr AH had negative views concerning the government's goal regarding nuclear power stations, he gave an example:

"This question is very simple on the surface if you start thinking about their position, but, I mean, for example, five years ago, people in the government decided that petrol engines were not good, so we all bought diesel, and now they have decided that diesel was not good, so we needed to buy petrol."

Mr AG said:

"We invested in HPC as a business activity, our operation abides by the contract which has been signed with the UK. UK selected EDF and CGN because the UK wants to develop safe and low-cost energy. We have fulfilled our duties in accordance with the contract's requirements which was signed with the UK, with no other responsibilities besides."

8.4.2.2 Factor of talent strategies

KCI-43 Employees' quality

Many employees at the HPC site were veterans of another very large construction project, such as, London's Crossrail; the next generation of workers destined for Hinkely would be relatively local from Bridgwater and Taunton Colleges, which are part-funded by EDF (Vaughan 2017a). Mr AG said:

"It is extremely important. Employees are the smallest elements of an enterprise. China has a proverb: the ants can destroy thousands of miles. Employees could destroy a company's projects and organisational management, if a company does not have a good quality of employee. Thus, our human resources department must control employee quality. The selection of employees should be very strict at the beginning of recruitment. High quality of employees is good for a company's development. In the project, we need

high quality employees to apply the technologies. Any technology problems, which happened in nuclear power construction could cause immeasurable danger. Therefore, employees must have high quality and they must meet nuclear power construction's requirements."

Mr AH said:

"I do not know what HPC's employee quality is like, a friend I know who works at HPC to train employees, which are from BSc. courses. Their employee quality should be fine."

Over 70% of CGN's total employees have been accredited with relevant university degrees. In order to cultivate nuclear power technology talents, CGN signed education agreements with Chinese universities, such as Chongqing University, Harbin Engineering University and the University of Science and Technology of China. The students were on courses studying Mechanical Engineering, Nuclear Engineering, and Technology and Energy, and Power Engineering at these universities. They needed to complete their courses over the first three academic years, but would also be required to finish CGN's training courses in their final academic year. These students would work for CGN directly, if they attained their university degrees, and passed CGN's assessment in their final year (CGN 2017b).

KCI-44 Employee localisation

HPC would create up to 25,000 jobs during construction. Some of these jobs would be in Somerset, but many more would be created across the rest of the country (Rivaz 2015). Half of the workforces at HPC would be locals, defined as people within a 90-minute travel radius (Vaughan 2017a). However, Mr AG considered:

"It is not important. As I mentioned, nuclear power requires the company and employees to know the technology. If local people do not know the technology, and we are required to solve local employment issues, the effect of this will be to invest more finance to train them. Moreover, British employees require a high salary and welfare, this is a cost issue. EDF cooperates with British sub-contractors to complete construction. But the core technology must use EDF and CGN's employees associated with it."

Mr AH explained:

"It needs both, you need to find the technical staff, so first, you can import some technical staff and then recruit local ones, you can try to employ 40 or 50 per cent within the locality, it is important to recruit local people, but they must be trained. So you need to look at a pretty small percentage, because most staff should come from the nuclear power industry. I think that's important."

KCI-38 The training and welfare of expatriate personnel

CGN has developed its training organisation system, a standardised and efficient personnel training management system, and a talent cultivation strategy for its business development, and nuclear power, and renewable energy projects. With respect to the expatriate personnel, each would have received training for 122 hours on average, and over 300 seminars have been organised for them, involving over 7,500 people in communication activities (CGN 2015a). Measures, to be adopted have included: education, training, and other policies to foster local technology, and management talent would create more employment opportunities. These employment measures would not only have addressed some of the employment issues, but would also enhance cohesiveness in communities, thereby, realising a "win-win"" situation among communities, corporations and residents (CGN 2016).

Mr AG illustrated his point:

> *"This is necessary, a simple example, after we came to the UK, we were not used to local food, we were missing home, so we lost working passion. Welfare is not only about money, it is much about support; support for Chinese staff who would live in the UK with their Chinese customs. Training included two parts, one part is vocational training, in order to ensure the expatriate had the ability to do this job. The other part is living training, at the beginning of living in the UK, Chinese staff could not completely understand British culture, could not communicate with local people in fluent English. So training in adjustment is necessary as well, the company needs to ensure that we are happy at work and living in the UK."*

8.4.2.3 Factor of external coordination abilities

KCI-51 Understanding local values and idiosyncrasies

Cultural differences between China and the UK could cause a barrier in respect of entry. CGN should adapt to the British social environment. It was important that the management philosophy of international business be explored through cross-cultural, beliefs and customs. However, respondents did not think it was necessary. Mr AG said:

> *"Depends on the content, as an international enterprise undertakes a project in the UK, we pay attention to British local values and idiosyncrasies, but we do not need to over complicate it. This is not necessary for headquarters, but it is important for the UK branch, it affects the relationship between the UK branch and the UK market."*

Mr AH explained:

> *"We used to send a lot of staff to work all over the world to, Africa, and Hong Kong particularly. I think that is a different culture but I do not think it usually causes problems, they can work abroad for long time, I do not think different values and idiosyncrasies affect us. So I do not think it is a matter for concern."*

KCI-4 Social responsibility

CGN was enthusiastic about public welfare activities, it responded positively to the call of central and local governments, and actively participated in enterprises designated to relieve poverty to help address the "three lacks" (lack of roads, water, and electricity), and was the designated partner of old district counties to provide aid to poor people. In 2015, CGN contributed a total of RMB ¥22.1 million Yuan in donations (CGN 2016). Ancillary facilities, such as water, electricity, and roads, which provided services for nuclear power projects could also provide services to local communities, and residents at the same time. Therefore, CGN would take into full consideration the demands of local communities in designing and constructing ancillary facilities for nuclear power projects to enable those ancillary facilities to play a greater role in improving transportation, production and the living environment of communities (CGN 2016). CGN's each nuclear base would provide more than 6000 jobs for local communities; and CGN cared about the development of culture, and education, and promoted education, and the cultural enhancement of communities. The annual education surcharge CGN paid to regions, where CGN nuclear power bases were located, reached more than RMB ¥100 million Yuan in total (CGN 2016).

With respect to social responsibilities pertaining to HPC, Rivaz (2015) noted that HPC's contribution to society, through job creation and skills development, was significant. EDF and CGN would not compromise on these values and China's success here depended on the same principle. He Yu, Chairman of CGN, said that entering the UK's nuclear market marked a new phase for CGN. At the same time this was also a triple-win for existing nuclear energy partnerships between China, France and the UK. CGN was highly committed to delivering safe, cost efficient, and sustainable energy, and to support the UK's goal of becoming a low-carbon society (EDF 2015). Further, He (2016) pointed out that the UK was an advanced, mature and tightly regulated market to showcase CGN's capabilities. Also, it would benefit the UK, in respect of jobs, skills, supply chains, consumers, and the environment. HPC and Bradwell would mean thousands of jobs and contracts potentially worth billions of pounds. When construction begins, CGN is committed to maximising opportunities for UK suppliers and the UK workforce.

However, Mr AG said:

> *"Honestly, we do not have social responsibility in this project. The company's purpose is to fulfil the contracts that it has signed with the UK, our tasks are to ensure our investment and operation in the project will proceed under British business rules. This is a different concept between Chinese and Westerners. The Chinese think an enterprise is to survive for profit. For Chinese companies, fulfilment of social responsibility is mainly to enhance the corporate image. Government should mainly carry out social responsibilities. For example, safety on a construction site requires the government establish related regulations and laws to supervise construction. The company must receive a serious penalty if they do not abide by the regulations and laws. So, a construction firm should focus on safety on a construction site."*

The above analysis of cluster corporate strategies revealed that CGN had specific corporate strategies with regard to its international business development, such as development strategies, talent strategies, and the ability to coordinate external factors. The corporate strategies have enabled CGN to understand the global nuclear power construction market, concerning communications, employee localisation, and local value, and to ensure CGN possessed the talents to undertake international projects. However, Mr AG's interview answers showed that CGN lacked the commitment to implement social responsibility measures.

8.4.3 Cluster three: Organisational capabilities

Thirteen KCIs have been placed into the cluster of organisation capability, these thirteen KCIs have been separated into three factors: behavioural capability, knowledge capability and information management capability (Figure 6.4).

8.4.3.1 Factor of behavioural capabilities

KCI-2 Organisation management

CGN has designated departments at its headquarters, and approximately 40 subsidiaries in different business areas. Since 2005, CGN has made inroads into new business areas, including wind, hydro, solar power and energy conservation, nuclear technology, financial services, and public services (CGN 2016). In order to invest in the UK, CGN established its UK offices named General Nuclear International with Company House (Company House 2017).

Respondent Mr AG praised CGN's organisational management:

> *"I think our company's organisational management is very good. The main task of organisational management actually is to improve the cohesion of the company. CGN has*

many branches, overseas offices and businesses, good organisational management facilitates headquarters' cohesion of all branches and employees, thereby, and ensuring these branches and employees can better negotiate division of labour and co-operation."

KCI-49 Management change

Culture, values and idiosyncrasies are different from China, and the UK. CGN could change its management style to adapt to the British market. Successful management of change is accepted as a necessity in order to survive and succeed in today's highly competitive and continuously evolving environment (By 2005). However, respondents had different opinions.

Mr AG noted:

"It is not important, the UK is one of our markets and one of our clients. Our task is to serve our clients, in order to make sure they are satisfied with our nuclear power projects. The Company's staff are mainly Chinese, so there is no necessity to change the management style."

Mr AH stated:

"Generally speaking, if you talk about technical things, it doesn't matter, technology is a universal language, nuclear power is much more about technology, it is not about management style, and I do not think that should change."

KCI-37 Leadership

Leadership was transformed by globalization, and post-modern leadership greatly impacted on relationships, work culture, collaboration, and outcomes when words, discourses and stories were realised as actions in the dynamic processes of organisational life (Hersted and Frimann 2016). It was an important factor in contributing to HPC's operational success.

Mr AH noted:

"You have got a good leader, but it does not mean that he should be totally running the job, nevertheless, he has to be there, to point in the general direction of where you are going, so, in that respect, it seems quite important."

Mr AG stated:

"Leadership is related to decision-making and management. For example, issues in employee management, cooperation with EDF, and the UK government, the construction period, and increased financial investment, all these require leaders to make decisions. HPC is a huge project, of employees working together, it requires the leader to have a

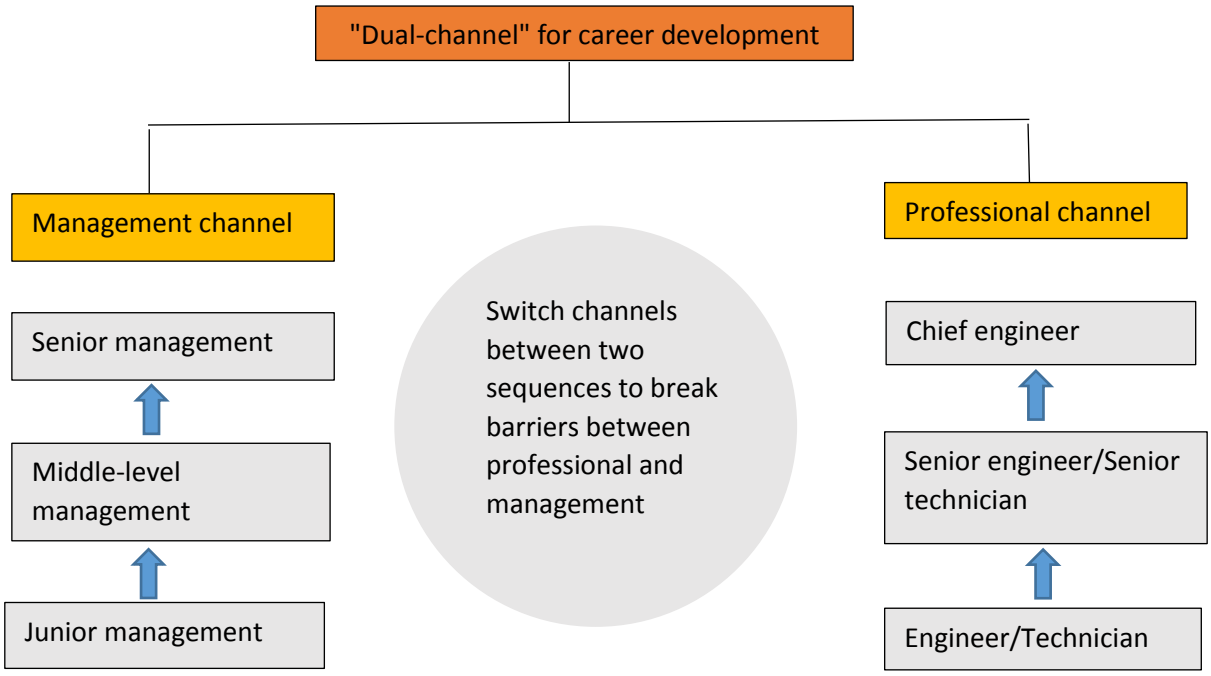
good ability to manage these employees. Leaders need to make orders explicit to employees, to make sure employees understand their tasks. So leadership is important for HPC's operation."

KCI-14 Employee management

Employees are the most dynamic elements in an enterprise and a key driver for its sustainable development. By the end of 2015, CGN had a total number of 34800 staff (CGN 2016). At HPC, approximately 1,800 were working on the project now (Vaughan 2017a), rising to 5,600 people to be employed on the site during peak construction (Gosden 2016). The finished power plant would employ 900 people (Moylan 2016).

CGN valued the contributions made by each employee, and placed great emphasis on the career development of employees. The company had two career development paths, namely, managerial and professional, and has established switching mechanisms of "dual-channel" (Figure 8.5).

Figure 8. 5: CGN's Dual-channel for employees' development



Source: Author's compilation from CGN (2015b)

"Dual-channel" involved the opportunity to break down barriers between professional and management whose aim was to cater better for employees' wishes for career development. By the end of 2015, a total of 424 employees moved to more suitable positions through internal market competition or by company deployment (CGN 2015b).

Mr AG explained:

> *"As I mentioned, nuclear power is a technical project, we must train employees and ensure they have the ability to do the job. We have assessment after training; the employee will be hired after they have passed the assessment. In HPC, the welfare we supply to employees is governed by British laws. But, employee management is mainly managed by EDF, we will pay attention to it in our project at Bradwell."*

KCI-48 Agility/adaptability/responses

In order to adapt to an international market, a construction firm must have its antennae tuned to signals of change in the external environment, to decode them and quickly act to refine or reinvent its business model, and even to reshape the information landscape of its industry (Reeves and Deimler 2011). However, respondents did not think it was important at HPC. Mr AH noted:

> *"I do not really think so. Generally speaking, people discuss technical issues in the nuclear power industry, so it was not about the culture involved."*

Mr AG said:

> *"Understanding British local culture and values will help us understand the local market, so that we can fulfil our contract requirements in the project. But the British demand that we can provide safe and cheap electricity, rather than we understand their culture."*

8.4.3.2 Factor of knowledge capabilities

KCI-33 Understanding the international construction market

Zhu and Dong (1997) pointed out that a firm's strategic goals and development strategies must be formulated based on market conditions. CGN needed to consider the UK market when they entered it, the key issue of that was to understand the UK market and those who were involved in it. It was important that a company selected an entry point that would lead to the most future growth opportunities in the target market (Stewart 2015). Both interviewees thought that this indicator was quite important for CGN. Mr AH said:

> *"Yes, the brilliance of this, managing a big construction project, you are going to use a lot of UK firms and labour, so yes, you need to understand it."*

Mr AG stated:

> *"We are an investor in HPC, this is our entry point in the UK market. It is important for us when undertaking UK projects in the future. We own advanced nuclear power*

technologies, but we need to know the demands of the market, so we can apply different technologies in different markets."

KCI-52 Corporate knowledge

CGN's corporate knowledge has been mainly reflected in two aspects: expertise and technologies. CGN has established a "customised" support model featuring "knowledge and experience sharing plus expert assessment" with the World Association of Nuclear Operators (WANO). And CGN has signed a strategic cooperation agreement with EDF, which has enabled CGN to seek excellent peer experts worldwide to provide support for its power plants (CGN 2015b). CGN obtained over 400 copyrights, patents and industrial design rights in nuclear power plant design, equipment procurement, construction, commissioning, operations, and modifications. HPR 1000, which would be employed at Bradwell B has already received design approval from China's nuclear regulator (He 2016). It was one of the core products of CGN, which was jointly developed by CGN, and the China National Nuclear Corporation; it possessed Chinese intellectual property rights, and has been supported by full fuel cycle capability. Safety was always the first priority during the design of HPR1000 technology. HPR1000 technology has achieved a high safety level at a reasonable cost (CGN 2015a). Respondent Mr AG expressed the view:

"Corporate knowledge is very important. We cannot undertake a project without these copyrights, or I say these technologies. Copyrights are our corporate knowledge. These copyrights are our brand, here, you need to take a clear view, the concept of brand is not important, the technologies of these copyrights are important."

Mr AH noted:

"I am surprised it obtained 400 copyrights, I keep repeating that it is a technical thing, unique people at the top who need to understand what is going on."

KCI-17 Research and development

CGN attached great importance to nuclear power technology Research and Development (R&D). During the 12th Five Year Plan, CGN's technical investment was almost RMB¥10 billion Yuan. The R&D investment in 2015 accounted for 5.53% of the main business income, which was higher than the required proportion standard of 2.5% stipulated by the government (CGN 2016). CGN had established eight state-level nuclear power R&D centres, and one state-level key laboratory in China to further add to its capabilities in order to simultaneously build, operate, and manage multiple nuclear, wind, hydro, and solar power, and other clean energy projects scattered across different regions worldwide (CGN 2016). In January 2012, CGN with AREVA and EDF agreed on a partnership to develop a Generation III reactor based on the CPR-1000, the ACE1000 (Areva-CGN-

EDF1000) (WNA 2017). At present, CGN had more than 2,000 R&D staff (CGN 2015b), and had 13 R&D projects in co-operation, which were conducted by CNNC, CGN and the Institute of Nuclear and New Energy Technology (INET) at Tsinghua University (WNA 2017). A total of 2,523 patents have been applied for, and two have been obtained from the Chinese Patent Golden Award (CGN 2016). Mr AG boasted about CGN's R&D:

> *"We have solid research and development teams which have a very strong ability in technologies relating to research and development. I believe that our research and development can meet the quality requirements of HPC and other projects in the UK, even in projects all over the world."*

KCI-9 Corporate culture

A unique corporate culture would have a comprehensive impact on the realization of management functions (Zhao 2004). Corporate culture facilitated control of organisational members' interactions with each other, and attracted outside people's interests in the organisation. But, respondent Mr AG had a different opinion:

> *"The culture in the company is important for CGN's development and corporate cohesion. But it is not important in HPC and it is not important for a business in a market. First, HPC is mainly operated by EDF, secondly, as I mentioned, as a construction firm, our task is to fulfil the contract to complete the project, and we do not need to demonstrate our corporate culture in the project, and in the market."*

KCI-6 Corporate experience

CGN had a rich corporate experience in nuclear power station operations, safety management, co-operation, and safety with respect to a healthy environment (Ruddick 2016). CGN accounted for 52% of the nuclear power under construction on China's mainland, and 20% of global nuclear power under construction (CGN 2016; He 2016). CGN and EDF have worked together in close cooperation for three decades to develop nuclear power in China, this included the joint venture between CGN and EDF to build two EPR reactors at Taishan. This was the same technology chosen for HPC (EDF 2015). EDF's Chairman, Jean-Bernard Lévy, said that this was a big step forward for EDF's 30-year-old partnership with CGN. CGN and EDF's experience and ability would successfully deliver HPC, and subsequent projects (EDF 2015). He (2016) pointed out that Britain would profit from the Chinese experience, earned through developing similar projects in China, such as Daya Bay, which was analysed in KCI-3 construction safety, and environmental safeguards, and KCI-26 safety management.

Mr AG stated:

> *"Yes, we have cooperated with EDF a long time, so we know how to effectively communicate and cooperate with EDF, as previous cooperation promoted trust between us. The experience of cooperation is a cooperative tacit understanding, when a project has any problems, we know how to cooperate with tacit understanding."*

8.4.3.3 Factor of information management capabilities

KCI-22 The ability of information acquisition

Those companies with strong information acquisition ability could quickly and accurately acquire a large amount of market information, which included external environmental changes, and information about competitors. This was because enterprises could formulate a strategic approach, and could respond quickly to the market (Jiang 2012). CGN needed to acquire the UK's market information when it entered the UK market. However, Mr AG was disappointed with CGN's information acquisition ability, he said:

> *"It is important, we live in an information age, and this is the same with communication. If information is missing or lost, it could affect the efficiency, quality and investment. Brexit is an example, it was a successful 10 years' relationship between the UK and China when Xi Jinping visited the UK in 2014, and so EDF was encouraged to bid for HPC with Chinese investment. However, with the Brexit vote the British government's position changed, and caused HPC to be suspended. This problem was caused by a lack of information, CGN did not actively acquire the information at the period of Brexit and did not expect the British government reconsider the investment of Chinese enterprises. I think that if we paid more attention to get market information by ourselves, rather than relied on government support, perhaps, we could have avoided the risks of Brexit. I mean, government has helped us to solve political issues, but we need to take the initiative to get the market information, in order to avoid economic risks, which have been caused by policy changes."*

CGN' organisational capabilities were investigated in the secondary literature, and primary interview data. CGN achieved international competitiveness through its leadership, employee management, understanding the international market, corporate knowledge, research and development, corporate experience, and information acquisition. However, respondents considered that management change, agility and corporate culture was not necessary for international nuclear power construction.

8.4.4 Cluster four: Financial capabilities

Eight KCIs have been divided into the cluster of financial capability, those eight KCIs have been classified into two factors: accounting, and management and resourcing (Figure 6.5). However, CGN as one of China's state-owned nuclear enterprises, did not disclose financial statements (CGN 2017a), thus, CGN's accounting factors could not be analysed in detail.

8.4.4.1 Factor of accounting

KCI-20 Profit

EDF and CGN stood to generate a profit of tens of billions of pounds on the £18bn project. Jean-Bernard Lévy, EDF chief executive, said that the company expected to make a nine per cent internal rate of return on the HPC investment based on a contract struck with the UK government in 2013 (Moylan 2016; Stacey and Stothard 2016). Interviewee Mr AH was surprised:

> *"Around 10 per cent of return, that is fantastic. This is quite a lot of profit if you can make it."*

However, Chinese respondent Mr AG considered:

> *"Actually, the profit in this project is quite low with 35 years of a payback period. But this is our first project in the UK; we are not looking for a high profit from HPC. We invested in HPC because the UK and China are communicating in the nuclear power business, our purpose is to enter into the UK market through HPC investment, and to improve our international influence in the global market."*

KCI-8 Costs

The cost overrun for HPC could reach £2.2bn, taking the total spend to £20.3 billion, up from £18 billion estimated in 2016 (Vaughan 2017b). Of which EDF invested 66.5%, and CGN covered 33.5%. Mr AH stated:

> *"Do I think is it too high, yes, it is. But, I think that's very good if a firm has the ability to finance the expensive costs, if you can do that without going to the bank, you are doing very well."*

Mr AG said:

> *"The cost is expensive, in fact, it could be cheaper, but many factors increased its cost, for example, Brexit, the new government's suspension caused the project to extend its construction period. This is a competitive advantage because CGN has the ability to finance the project. Otherwise, EDF could not find the necessary funds to invest. For*

example, both China and Japan have the ability to undertake nuclear power station construction, but China has the financial strength to invest, so China has a competitive advantage over Japan. But, it is not enough to only have the financial ability, other factors, such as technology, leadership and organisational management are important."

KCI-15 Revenue

Hinkely Point C could eventually cost British taxpayers almost £30 billion in payment to EDF and its Chinese partner (Ruddick 2016). In return, EDF and CGN would receive a guaranteed price for Hinkley's electricity for 35 years. EDF's expected return on its investment is set to be between nine per cent and ten per cent (Moylan 2016). However, consumers are locked into paying for HPC via energy bills for 35 years, and the total cost has risen from £6 billion to £30 billion (National Audit Office 2017). Mr AH stated:

"It is certainly not reasonable for EDF and CGN to gain revenue from tax, but there is no other way of doing it."

But Mr AG explained:

"This is reasonable, the main cooperation purpose for the UK, France and China in HPC is to make revenue, and the purpose of a company is to make money. The British government has said that they will supply safety, and low-cost energy from HPC, but actually, they want to make revenue from this project, along with EDF and CGN. We will operate this power station to supply electricity to consumers; therefore, consumers should return revenue to us. But I think that 35 year payback period is quite long time."

KCI-13 Assets

By the end of 2015, CGN's total assets were estimated at RMB ¥430.7 billion and net assets were RMB ¥129.6 billion (CGN 2016). CGN is 90% owned by the central Chinese Assets Supervision and Administrative Commission, and 10% owned by the People's Government of Guangdong Province (European Commission 2016). CGN's proportion of assets included 64% of nuclear power, 2% of nuclear fuel, 28% of new energy, 5% of finance, and 1% of other components (CGN 2016). Both respondents considered that assets were a neutral important indicator for CGN's competitiveness in the UK. Mr AG stated:

"Assets contribute, the UK assesses the financial capacity of CGN, but it does not contribute to its absolute impact."

8.4.4.2 Factor of management and resourcing

KCI-29 Cost control

As mentioned in the indicators of KCI-8 cost, HPC's costs have increased from £18 billion to £20 billion. Mr AG had negative views of CGN and EDF's cost control ability, he said:

> *"In the current situation, I think EDF and CGN lack cost control ability. We need to improve cost control in risk management. Cost increased every time risks happened. If costs keep increasing, we could not afford it. But this project relates to three countries: the UK, France, and China, so it is complicated to give details."*

KCI-27 Financing methods and KCI-18 Source of finance

At the firm's level, the State-owned Assets Supervision and Administration commission of the state council held a share of 90%, and Guangdong Hengjian Investment Holding Co., on behalf of the Guangdong Provincial Government, held a share of 10% of CGN (CGN 2016). In respect of HPC, EDF owned two-third (66.5%) of HPC and CGN owned a third (33.5%) (Ruddick 2016). CGN has agreed to cooperate with Taian Lurun Co., Ltd. as a partner of the Chinese investment fund consortium of the HPC project. Taian Lurun has agreed to invest 10% of the total Chinese equity of £6.03 billion Pounds into HPC, in principle, not less than RMB ¥3 billion Yuan, or converted into an equal amount of British currency (Lurun 2016). The project would also benefit from the Government's Infrastructure Guarantee Scheme. The Chancellor announced the initial £2 billion of the scheme during his visit to China in 2015 (EDF 2015). Mr AG commented:

> *"This is an appropriate method of financing, it is better than borrowing money from banks. This kind of financing method ensures that we have sufficient funding, and we can cooperate with other firms to make a profit. This is one of universal financing methods currently."*

However, Mr AG did not think CGN's source of finance should be one of elements to persuade EDF and the UK government to favour CGN. He commented:

> *"Our source of finance ensures that we have good financial capability. But, in this case, it is not an important indicator. Few countries in the world can operate nuclear power projects. British has agreed that China's investment was mainly influenced by China's nuclear power technology. Of course, the UK considered the national relationship with China as well, but not CGN's source of finance."*

KCI-42 Knowledge of the project countries' accounting and tax systems

Each country had different financial policies, accounting procedures and tax systems (O'yang 2010). The different systems between China and the UK could increase the difficulty of financial management at HPC, and following projects in the UK. Both respondents strongly agreed that this indicator was very important. Mr AG said:

> *"We need to run a prototype, and operate more projects in the UK in the future. Firstly, our investment must meet British law and financial regulations, the UK's department operations will involve a lot of financial issues, so this is very important."*

Mr AH noted:

> *"Tax methods are very complicated, firms must deal with tax, and use legitimate methods to avoid it."*

It can be seen that CGN's strong financial capability mainly relied on Chinese government support, because CGN was a central enterprise. But CGN could consider that it could improve its financial capability through its stock, as a listed enterprise.

8.4.5 Cluster five: Policies

Respondents in the Modified Delphi interviews have proposed five KCIs relevant to policies. These five KCIs have been classified into four factors: national policy, diplomacy, industrial regulations, and the political environment (Figure 6.6).

8.4.5.1 Factor of diplomacy

KCI-24 The relationship between China and other countries

The UK has continued to solicit international partners to achieve its civil nuclear plans. During the visit of Chinese premier Li Keqiang to the UK in 2014, the two Governments issued a joint statement, and signed a memorandum of understanding confirming that the UK would be open to the possible use of China's own reactor designs in the UK (Gosden 2016). China's participation in the UK's new nuclear programme was strongly endorsed by the Chancellor and the Energy Secretary during their visit to Beijing. They showed their strong commitment to HPC and provided a powerful answer to those who doubted that the country could get its act together concerning infrastructure (Rivaz 2015). During the Chinese president, Xi Jingping's visit to the UK in October 2015, the Chinese government announced a £40 billion contribution to the UK-Chinese partnership, including Hinkely (Davies 2016). In the presence of the Chinese President, Xi Jingping, and the British Prime Minister, David Cameron, EDF and the China General Nuclear Power Corporation signed a Strategic Investment Agreement for joint investment for two EPR reactors at

Hinkley point C (EDF 2017). Hinkely became a prime example of how three great nations could collaborate together to enable a piece of critical infrastructure to happen by pooling their technology, resources, and expertise (He 2016).

However, Ridley (2017) considered that it was time to scrap HPC. The government reviewed HPC in 2016, which was bad diplomacy. But, if the initiative to suspend the project came from China, it might just be possible that some new arrangement could be salvaged from the certain wreckage of the EDF scheme, without seriously damaging both livelihoods, and the UK's relationship with China. Mr AH agreed with this view, he said:

> *"I think that is desperately true. I am sure that something can be salvaged; absolutely, this would benefit both sides, because they have too many partners already, spending money very early. I think they should stop this project."*

But, Mr AG did not think this project related too much about national relationships, he commented:

> *"The relationship between the UK and China encouraged CGN's investment. But this project is mainly a business activity, the British need to build a nuclear power station; EDF and CGN have the ability to build it. On the contrary, the project affected Sino-British relations, a lot of media were against Chinese investment; they felt that China's investment might leak British nuclear secrets. It is difficult to say that it would be good to stop this project or not, because contracts were signed, we cannot breach those contracts."*

8.4.5.2 Factor of national policy

KCI-31 National policy

China's policy was to "go global" by exporting nuclear technology including heavy components in the supply chain (WNA 2017). Ever since Tony Blair committed the UK to a new nuclear programme in 2006, successive governments have argued that nuclear power was a necessary part of the UK generation mix (Moylan 2016). China possessed a determined policy of National Development, and at the Reform Commission level of exporting nuclear technology, based on the development of the CAP1400 reactor with Chinese intellectual property rights, and supported by full fuel cycle capability. The policy has been pursued at a high level politically, by utilising China's economic and diplomatic influence. In 2015, the HPR 1000 reactor became the main export product for CGN, with its focus on Europe (WNA 2017). However, respondent Mr AG considered that the national policy was a neutral driver of CGN's competitiveness; he said:

> *"The national policy is a macro impact on Chinese overseas projects, but it does not affect our actual operation in the project."*

8.4.5.3 Factor of political environment

KCI-23 China's political influence

China's rapid economic growth has made China the second largest economy in the world. A country with a weak economy could not support its enterprises' large-scale overseas investment and trade. Therefore, China's increased global competitiveness has provided a basic political condition for Chinese enterprises abroad (Long 2014). China's international image and status provided reliable trust for Chinese construction enterprises to participate in a host country's construction market (Yuan 2011). However, both respondents held different individual views from those provided by the literature. They considered that the HPC project was different from the African market; the UK government could not primarily consider China's political influence.

Mr AG commented:

> *"China's political influence has promoted Sino-British friendship, and has promoted our investment in the UK market, but China's political influence on the project has had an indirect impact, not a direct impact. Because only a few of the countries can operate a nuclear power station, the UK agreed to China's investment, and ignored China's political influence, as it took into account China's nuclear power technology."*

KCI-47 The political environment of project countries

Davies (2016) stated that the UK's stable regulatory and legal system attracted investors to invest. But, any post-EU restrictions on freedom of movement could affect Hinkley and its highly specialised work, as EDF's chief executive, Vincent de Rivaz, alluded to recently. The UK's decision to leave the European Atomic Energy Community's cooperation treaty while exiting the EU could also be detrimental to the project. New bilateral deals must be put in place to ensure nuclear materials could continue to arrive in the UK (Vaughan 2017a). Mr AG considered:

> *"The changing political environment could affect policy and economic impact, such as, some laws and regulations might be changed after Brexit; this will affect our future construction in the UK, now, we do not know the details yet. But I would say that the risks of the UK's political environment will affect our operations on future projects."*

8.4.5.4 Factor of industrial regulations

KCI-50 Regulations and legal frameworks

As China's nuclear power industry was at an early stage with respect to exports, it failed to conform and adapt to global regulations and legal frameworks, thus, Chinese nuclear enterprises were unable to participate in international nuclear power station projects (Suo 2017). But, The UK

had a state of the art supervisory regime and legal system. Its regulatory authorities were experienced and adequately resourced to ensure the safety of nuclear plants. China likewise had a fine record of 30 years in safely operating nuclear facilities. Its nuclear energy programme and supervision have been highly acknowledged by international agencies. The three HPC partners were members of the International Atomic Energy Agency. Consequently, the French and Chinese partners were subjecting themselves to both international and British standards (Liu 2016). However, both respondents considered that it was a difficult task for CGN to meet all Chinese, international, and British standards. Mr AG explained:

> *"China complies with British laws and regulations when undertaking projects in the UK. But it cannot realise that we can abide by two countries' laws and regulations together, and we cannot develop common regulations for the two countries' nuclear power construction, because market demands are different. For example, in China, workers are allowed to work to 12o'clock at night to speed up the construction period, but it cannot do that in the UK."*

But Mr AH considered:

> *"Totally possible whether they will, but they need to look at it very hard, I am sure there is nuclear power expertise is in England, China could work with anyone, so they could possibly meet both countries' regulations and legal framework, and develop a common one."*

CGN entered the British nuclear power market based on the Chinese government's policy support. Although policies provided an opportunity for CGN, it was significant to consider how sustainable in expanding the global market by CGN itself would be in the future. This showed that a competitiveness framework was important for CCFs' global business expansion.

8.5 The competitiveness scores of CGN

This chapter analysed CGN's international competitiveness with its involvement in HPC through analysis of the secondary literature review and primary structured interview data. Structured interviews allowed the author to gain profound individual views on CGN's expansion in to the UK's market through HPC's investment and revealed CGN's international competitiveness scores by respondents' ratings. Table 8.1 indicated two respondents' rating scores in each KCI. Some indicators were not rated by respondents because they were not aware of the details of those indicators in HPC. For example, contract management was mainly managed by EDF, thus Mr AG could not explain the details of it and he could not rate its importance relating to HPC's operation.

Table 8. 1: CGN's international competitiveness

Competitiveness Framework (based on Figure 6.6)			**Interviewees rating score**	
Clusters	**Factors**	**KCIs**	**Mr AG**	**Mr AH**
Project operation	Quality	KCI-1 Project quality	5	5
		KCI-34 Quality assurance	4	5
		KCI-30 Project warranty	5	5
	Safety and health	KCI-3 Construction safety and environmental safeguards	3	1
		KCI-26 Safety management	3	5
	Technology	KCI-35 The ability to apply advanced technologies	4	4
		KCI-36 the choice of selection of construction technology in the preliminary construction scheme	5	5
		KCI-5 Technology management	5	/
	Contract	KCI-39 Contract management	/	/
	Productivity	KCI-10 High productivity	3	4
Corporate strategies	Development strategies	KCI-12 Reputation	2	4
		KCI-53 Brand	1	4
		KCI-16 Risk management	1	4
		KCI-32 The level of internationalisation	1	5
		KCI-7 Communication and cooperation	5	1
		KCI-11 Valued-added for stakeholders	4	/
	Bidding	KCI-28 Bidding price	/	/
		KCI-46 The strategy of bidding	/	/
	Talent strategies	KCI-43 Employees' quality	5	5
		KCI-44 Employee localisation	1	5
		KCI-38 The training and welfare of expatriate personnel	5	/
	External coordination ability	KCI-51 Understanding local values and idiosyncrasies	3	1
		KCI-4 Social responsibility	3	3
Organisation capabilities	Behavioural capability	KCI-2 Organisational management	5	5
		KCI-49 Management change	1	1
		KCI-37 Leadership	5	5
		KCI-14 Employee management	4	5
		KCI-48 Agility/adaptability/responses	1	1
	Knowledge capability	KCI-33 Understanding the international construction market	3	5
		KCI-52 Corporate knowledge	5	4
		KCI-17 Research and Development	4	/
		KCI-9 Corporate culture	1	/
		KCI-6 Corporate experience	5	5
	Information management capability	KCI-22 The ability of information acquisition	5	5
		KCI-40 Information management	/	/
		KCI-21 Information technology	/	/
Financial capabilities	Accounting	KCI-20 Profit	3	/
		KCI-8 Costs	4	5
		KCI-15 Revenue	3	3
		KCI-13 Assets	3	3
	Management and resourcing	KCI-29 Cost control	5	/
		KCI-27Financing methods	3	/
		KCI-42 Knowledge of the project countries' accounting and tax systems	5	5
		KCI-18 Source of finance	3	/
Policies	Diplomacy	KCI-24 The relationship between China and other countries	3	5
	National policy	KCI-31 National policy	3	1
	Political environment	KCI-23 China's political influence	5	1
		KCI-47 The political environment of project countries	5	1
	Industrial regulations	KCI-50 Regulations and legal frameworks	1	3

According to the Equation 7.2 and Table 7.4, CGN's competitiveness could be calculated based on respondents' ratings. Using Mr AG's rating scores as an example.

First, each factor score needed to be calculated, for example, the factor of quality (F1-1):

$$S(F1-1)=\sum_{i=1}^{3} W(KCI-i)*S(KCI-i)=0.357*S(KCI-1)+0.345*S(KCI-34)+0.298*S(KCI-30)$$
$$=0.357*5+0.345*4+0.298*5=4.655$$

By applying the same mathematical method, it was possible can calculate the scores of other factors (F1-2, F1-3, F1-4 and F1-5) in cluster one (C1), therefore, the cluster of project operation (C1) could be calculated:

$$S(C1)=\sum_{i=1}^{5} W(F1-i)*S(F1-i)$$
$$=0.301*S(F1-1)+0.189*S(F1-2)+0.311*S(F1-3)+0.106*S(F1-4)+0{,}093*S(F1-5)$$
$$=0.301*4.655+0.189*3+0.311*4.663+0.093*3=3.697$$

By applying the same mathematical method, the scores of other clusters could be calculated (C2, C3, C4 and C5). Thus, the CGN's competitiveness score of Mr AG was:

$$CGN's\ CV=\sum_{i=1}^{5} W(Ci)*S\ (Ci)$$
$$=W(C1)*S(C1)+W(C2)*S(C2)+W(C3)*V(C3)+W(C4)*V(C4)+W(C5)*V\ (C5)$$
$$=\ 0.219*S(C1)+0.264*S(C2)+0.265*S(C3)+0.156*S(C4)+0.096*S(C5)$$
$$=0.219*3.697+0.264*2.294+0.265*3.019+0.156*2.530+0.096*3.398=2.936$$

By applying the same mathematical method, CGN's competitiveness score for Mr AH was 2.608. Respondents Mr AG and Mr AH had similar competitiveness scores to CGN. In the 5-point Likert scale, score three meant neutrality, CGN respectively received competitiveness scores that were 2.936 and 2.608 in Mr AG and Mr AH's rating scores, this meant CGN achieved neutral competitiveness in the UK nuclear power sectors from their individual views.

Table 8.1 revealed that CGN's competitiveness in the UK could be investigated through HPC based on the competitiveness framework (Figure 6.6). It provided KCIs for reference to CCFs, and a mathematical method to assess a CCF's competitiveness was produced. This meant the competitiveness framework was practicable.

8.6 Summary

This chapter sought to validate the competitiveness framework through analysis of CGN's international competitiveness based on both secondary and primary data.

Nuclear power “go global” has been promoted as a national strategy in China. Nuclear power has become an important topic in bilateral political relationships and economic exchanges with potential importing opportunities to countries for nuclear energy. It has been the vanguard for products “made in China”, and for Chinese equipment to go global. It was also a reflection of the nation’s comprehensive strength. However, building a nuclear power station would be expensive, and prone to cost and time overruns. The HPC project has been already heavily subsidised by UK taxpayers, while EDF oversaw the project, and was under significant financial stress. That was the reason EDF brought CGN on board to take a 33.5% stake in the project, and to help spread the financial load. China was also expected to play a significant role in future reactors at Sizewell in Suffolk and Bradwell in Essex after its investment in HPC.

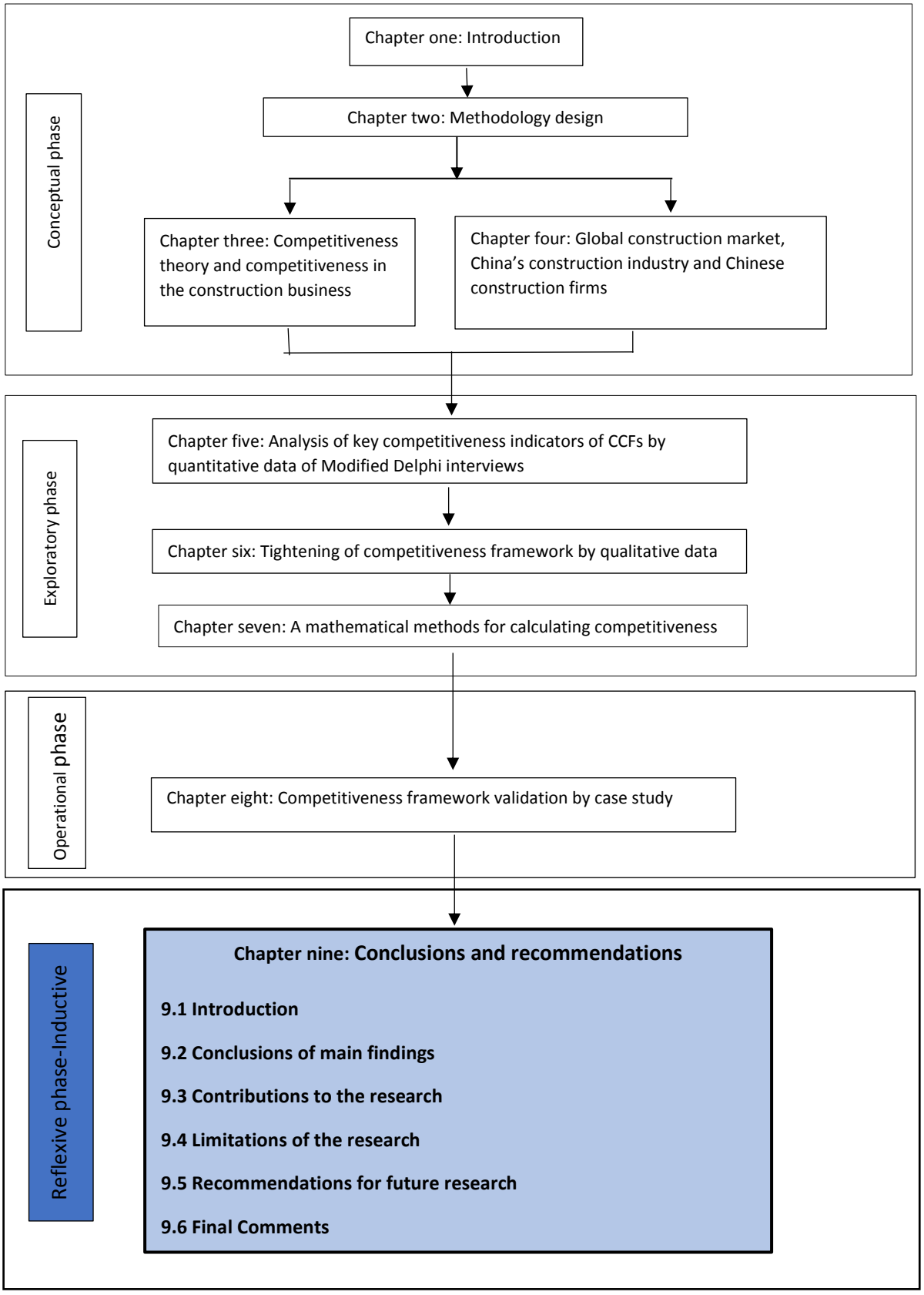
However, critics have opposed HPC, because of its expensive cost, national security issues, and radioactive waste. CGN and EDF have responded that first, HPC was worthy of investment, because HPC would bring positive economic benefits to the UK. Once completed, HPC would deliver 7% of the UK’s electricity, when most other nuclear power stations had been closed down. The construction was expected to provide a considerable number of jobs for local workers. Secondly, the control system of the HPC would follow the UK’s safety monitoring system, and would not be associated with an external information system or the internet. British nuclear regulatory authorities believed that the safety of HPC has been properly solved and has issued the nuclear power plant a licence for HPC. Thirdly, CGN and EDF have made efforts to minimize the generation of radioactive waste, practically, and to implement the principle of As Low as Reasonably Achievable on the management of radioactive waste, and continuously to monitor the controlling and processing of technology in respect of radioactive waste.

This case study tested the practicability of the competitiveness framework. Almost each of the KCIs of the competitiveness framework was analysed using both secondary literatures, and respondents’ answers. The case study validated the competitiveness framework in practice. CGN’s international competitiveness was summarised in Table 8.1 based on respondents’ answers and ratings. The application of the competitiveness framework to the case study provided a useful learning tool. This case study explained that CGN brought international competitiveness to the UK nuclear power market, because of CGN’s nuclear power station operational experience, advanced technology, and strong financial capability. The national friendship between China and the UK supported opportunities for CGN’s entry into the UK market, but UK customers were more interested in the low cost of green energy, rather than an expensive nuclear power station. Thus, when referring to the competitiveness framework, CGN must consider those competitiveness indicators in the UK market. First, KCI-17 research and development, innovating nuclear power technologies, and ensuring that nuclear power reactors were safe in use. Secondly, pay attention

to KCI-7 communication and cooperation, to communicate with the public, in order to promote safe nuclear power technology and allow local people to know CGN. Thirdly, attention should be paid to KCI-16 Risk management and KCI-47 The political environment of project countries, including Brexit issues could affect the UK construction market, because the UK may no longer abide by the < EU Industrial Emissions Directive>, which could affect the nuclear power station's operation (Wang 2016). CGN should seek to independently obtain political information in order to reduce political risks.

Chapter Nine

Conclusions and recommendations



9.1 Introduction

This chapter concluded the study by presenting the key conclusions, contributions, and limitations of the research. Furthermore, the potential areas for further research have been recommended.

The overall aim of this research was to investigate key competitiveness indicators influencing the CCFs' competitiveness in the global construction market in order to establish a competitiveness framework to improve CCFs' international competitiveness. In order to address the research aim, five objectives were postulated and all of these objectives were met:

Objective 1: Systematically review theories and concepts of competitiveness.

Objective 2: To posit a conceptual competitiveness framework based on identifying the key competitiveness indicators (KCIs) from secondary data.

Objective 3: To refine the draft conceptual competitiveness framework.

Objective 4: To apply a mathematical method to calculate a construction firm's competitiveness.

Objective 5: To validate and reflect on the implication of the competitiveness framework.

9.2 Conclusion of main findings

Theories and concepts of competitiveness

Competitiveness was seen as a powerful concept, it should encourage sustainable development, and should be central to modern construction firms' principles. This was particularly true for today's construction market, which could be characterized by increasing turbulence, and intensifying competition. Construction firms have been required to improve competitiveness to survive in the market, and then to promote sustainable development. The three main schools of competitiveness: Porter's Competitive Advantage and Competitive Strategy Models, the Resources-Based and Core Competence Approach, and the Strategic Management Approach, all addressed the concept of competitiveness of construction firms, but the limitations remained in their applications. The three theories were complementary rather than contradictory, each supporting the attainment of competitive advantage. By combining these three competitiveness schools of thought, an initial theoretical framework for explaining firms' competitiveness was advanced. However, a universal and exact definition for competitiveness did not exist. Moreover, the existing theories, models and frameworks could not be applied or used in developing firms such as CCFs, because of CCFs' special characteristics of organisational transformation and development. First, China's construction industry had gone through a transition from a centrally planned economy to a socialist market economy; it required strong governmental supervision over the majority of construction companies. Secondly, CCFs have been transformed from non-

profit organisations to global engineering and construction enterprises, a key driver for their entry to the international construction market as a major strategy. Therefore, this research developed a specialised framework related to the international construction market.

Identifying the key competitiveness indicators (KCIs)

The secondary literature reviews revealed that construction firms' competitiveness came from three clusters: business strategies, organisational capabilities, and financial capabilities. A total of 21 KCIs emerged from secondary literature, including quality, organisational management, safety, and a healthy environment, social responsibility, technology management, corporate experience, communication and cooperation, costs, corporate culture and high productivity. A draft conceptual competitiveness framework was established through these 21 KCIs (Figure 4.8). These 21 KCIs, and associated areas were general and applicable to most countries' construction enterprises, however, the characteristics of China's construction industry and CCFs were special, those 21 KCIs could not cover all of CCFs' characteristics, which included a socialist market economy that was moving towards increasing integration into the world community; there were a large number of unique characteristics relating to CCFs as they evolved from a particular social and economic background, although they have been transformed towards an international framework, such as, the CCFs' method of undertaking international projects and external relationships with governments. Therefore, the research conducted interviews with industry experts who understood these complex issues, in order to identify the CCFs' unique competitiveness indicators.

Refining the conceptual competitiveness framework

Modified Delphi interviews, were adopted in this research, and have made the KCIs for CCFs' competitiveness more robust. The interview results illustrated that the CCFs' competitiveness was contributed to by five clusters (Figure 6.6): project management, business strategies, organisational capabilities, financial capabilities, and policies. 49 KCIs have been identified by conducting Modified Delphi interviews, and these 49 KCIs were classified in to 18 competitiveness factors. All 49 KCIs and 18 competitiveness factors determined the performance of the five clusters. KCIs and competitiveness factors were used to assess and improve the competitiveness of individual CCFs. Consequently, all the clusters, competitiveness factors, and KCIs were ranked into a hierarchical system, referred to as a competitiveness framework with an analytical hierarchy process, which allowed the clusters, factors and KCIs to be identified in a logical way to be more robust and comprehensive. The analytical hierarchy process, for structuring competitiveness clusters, factors and indicators, was found to be effective. The hierarchical structure was effective in reflecting the nature of construction firms' competitiveness, and was

helpful in understanding the concept of competitiveness. This approach has also been echoed by other existing studies investigating competitiveness indicators.

However, the gaps appeared between the secondary literature review and primary interview data. The literature review overlooked both a project's operation and policy that constituted the main aspects of competition at a firm's level. A project was a major source of competitiveness for construction firms' production. Policy constitutes the macro condition of an enterprise's development, especially, as China published policies concerning infrastructure development in order to boost its national economy, and strengthen its bilateral relationship with other countries. Therefore, it was necessary to analyse policy issues when identifying CCFs' international competitiveness.

Calculating a construction firm's competitiveness.

The research used a Weighted Summation (Equation 7.2) method for calculating competitiveness. It is considered one of the simplest mathematical methods for assessing objects based on multiple indicators which were interrelated and classified at different levels. It was without heavy computations and complex algorithms. This research proved that a construction firms' competitiveness could be calculated. A competitive score contributed to assess a construction firm's competitiveness, and made it possible to compare its competitiveness with rivals' competitiveness in the market. In addition, a construction firm could understand its competitive advantages and disadvantages based on the scores of each KCI, factor and cluster, and then from them to improve its competitive advantages.

The implication of the competitiveness framework

The competitiveness framework (Figure 6.6) was applied to China General Nuclear Corporation's (CGN) operation at Hinkely Point C nuclear power station (HPC). Primary structured interviews complemented by the secondary literature review was utilised to investigate the practicability of the competitiveness framework. The case study of CGN provided a rich array of evidence that validated the competitiveness framework. It indicated that the firm (CGN) took advantage of its cutting edge technology, and ability to finance such an important project despite political uncertainty and a hostile local community. Furthermore, the case of CGN demonstrated the importance of political support from the country of origin (China) to negotiate a long-term strategic partnership with the host country (UK). The case study proved that the competitiveness framework was practicable and provided a useful learning tool to assess and improve the Chinese construction firms' international competitiveness.

9.3 Contributions to the research

Conceptual contribution

This research has enriched the concept of a firm's competitiveness, in particular, the knowledge of a Chinese construction firm's competitiveness. Competitiveness theory divided competitiveness into four levels: country, industry, firm, and product. Much existing research analysing a construction firm's competitiveness only focused at firm's level, such as resources, organisational management, and financial capabilities. However, the relationship between the firm with product, industry, and country had been ignored. By investigating the characteristics of global enterprises and China's construction market, this study has added to the body of knowledge concerning CCFs' operations, and competition practices in the international market. The competitiveness framework developed in this research has provided a useful learning tool to analyse of CCFs' competitiveness in international construction markets.

Methodological contribution

Porter (1998) considered that a universal and exact definition of competitiveness did not exist. This research could not exactly demonstrate what competitiveness was, but has identified the KCIs based on mixed research methods of sequential explanatory strategy, and the Modified Delphi method interviews. This approach clearly identified the KCIs of CCFs' international competitiveness. Therefore, this research has provided a valuable framework of reference for researching competitiveness issues in other industries.

The application of a Mathematical Method for Calculating Competitiveness was another unique feature of the methodological approach in this research. The research developed a pragmatic approach without heavy computation and complex algorithms. The Weighted Summation technique, seen as one of the simplest multi-criteria evaluation methods was adopted to assess an organisation's competitiveness on the practical side. This method of calculation allowed for calculating the competitiveness by applying Equation 7.2: $CV = \sum_{i=1}^{I} Wi * S(Ai)$.

Policy contribution

This research underlined the role of national policy in supporting the international business operations of CCFs. Chinese firms could not extend their global market presence without the Chinese government's "One Belt One Road", and "Go Out" policy initiatives. Therefore, understanding and applying Chinese government policies was one of the key competitive advantages for CCFs. As a result, this research has contributed to the understanding of the linkage between national policy and firms' competitiveness in the international arena.

Practical contribution

Understanding the nature of CCFs' operations at international level has provided a rich insight in to the characteristics of Chinese construction companies. However, this research has shown that CCFs needed to develop a more proactive strategy regarding their operations in different countries. It revealed that many CCFs ignored the significance of public relations, and overlooked understanding of local communities and different cultural nuances. As the operations of Chinese companies was attracting more scrutiny, it was therefore very important for those firms to reduce their dependence on Chinese Government's support by becoming more competitive on their own merits.

9.4 Limitations of the research

Although a great effort has been made in this research to attain its aims and objectives, there were factors that were beyond the author's control that constrained the scope of the study. The first limitation in this research was research samples. First, the research sample, which identified the 21 key competitiveness indicators, emerged from the top global construction firms which had overseas businesses, including 60 international and 27 Chinese firms. Therefore, the key competitiveness indicators were not necessarily suitable for small and medium construction firms. Second, the possible limitation related to the Modified Delphi interview samples. Interviewees were mainly selected from Chinese experts, with only two UK experts who participated in the research. This was particularly useful to gain a deeper understanding of key competitiveness indicators that influenced CCFs' international competitiveness. However, the limited number of international experts could potentially have affected the competitiveness framework's application to international construction firms. Additionally, the limited number of international experts could prejudice comparison of different competitiveness issues between CCFs and international construction firms. Third, the possible limitation related to the small sample of structured interviews in the case study. Only two respondents participated in case study interviews. The small number of interview samples could not significantly represent a wide range of views on the case's issues.

The second limitation of this research was market selection. This research generally analysed CCFs' competitiveness outside China. The interview questions and the respondents' answers mainly considered the CCFs' competitiveness on overseas business. Therefore, the competitiveness framework might not be applied to China's domestic construction market.

The third limitation of this research was the important relationship between each KCI. This research identified 49 KCIs, which were important to CCFs' global businesses. But this research did not investigate the important relationship between each KCI; for example, the relationship

between risk management, project quality and cost control were not investigated. Thus, the competitiveness framework (Figure 6.6) listed the KCIs' contribution to CCFs' international competitiveness, but the important relationship between each KCI was not revealed. The main reason for these limitations was time constraints, which are related commonly to a doctoral degree study. These limitations are recommended strongly to be addressed in any future research.

9.5 Recommendations for future research

Suggestions for further research envisaged solutions to overcome the limitations of this thesis, in addition to areas that deserved further investigation. First, it was of great importance to compare the different competitiveness issues between CCFs and international construction firms, to recognise what were the gaps between their project operations, business strategies, organisational management, financial capabilities and policy supports. Additionally, to investigate where it might prove to be possibly effective for improving CCFs, and international construction firms' competitiveness through applying each other's competitiveness frameworks and models.

Secondly, it would be significant to conduct a comparative study on the competitiveness of contractors in different regions. By identifying a set of key competitiveness indicators, and by establishing a competitiveness framework, this study has built up an effective methodology for assessing and improving CCFs' competitiveness outside China in the general construction industry. This methodology is recommended for studying the subject in different markets, in particular, in construction sectors. It is considered that this kind of research would add knowledge on competitiveness management taking place in those most attractive construction markets.

Thirdly, it would be significant to investigate the importance of relationships between each KCI. This study has established a competitiveness framework with 49 KCIs for CCFs' global business expansion. This research is recommended for investigating the important relationship between each KCI, in order to identify how one KCI's performance affected another KCIs' performance, and then impacted on a construction firm's competitiveness.

Finally, this research has contributed to knowledge regarding the competitiveness concept, and the framework's application, it would, moreover, recommend the education sector to add to this knowledge in curriculum development. Especially, in universities, which taught relevant international construction management courses. It could be added to a competitiveness course, in order to broader students' knowledge in international construction operations. Professional institutions, such as Royal Institution of Chartered Surveyors (RICS), the Chartered Institute of Building (CIOB) and the Association for Project Management (APM), could apply the competitiveness framework as a learning tool for training. It could, also, benefit organisations'

decision-makers and policy makers to understand the notions and drivers of competitiveness, and then, to improve the organisational and national standards for firms to achieve competitive and sustainable development. These recommendations for future research have demonstrated that this study could be explored and extended in multiple directions. However, this thesis has achieved its ultimate goal of identifying key competitiveness indicators influencing CCFs' competitiveness in the global market, in order to establish a competitiveness framework, and original research contributions have contributed to the existing body of knowledge in the disciplinary area of construction firms' competitiveness.

9.6 Epilogue

In line with the development of the global and the Chinese construction market, Chinese construction firms' global businesses have been an exciting development with the assistance of the Chinese government's policies over recent years. This thesis has identified the key competitiveness indicators contributing to Chinese construction firms' international operations. The results of this research have established a competitiveness framework to assess and improve Chinese construction firms' international competitiveness. The quality of the research has been further externally validated by publications by the author. The following chapter, and conference presentations have been generated during this research project:

Book's chapter:

> Li, P. (2017) Construction firm's competitiveness. In: Huston, S. ed. *Smart Urban Development*. Routledge: 137-158

Conference presentations:

1) Li, P., Parsa, A., Huston, S. and Kashyap, A. (2017) *The international competitiveness of Chinese construction firms.* Presentation at the European Real Estate Society 24rd Annual Conference. 28th June-1st July 2017. The Netherlands
2) Li, P., Parsa, A, Huston, S. and Kashyap, A. (2016) *The international competitiveness of Chinese construction firms—a modified-Delphi study*. Presentation at the European Real Estate Society 23rd Annual Conference. 08-11th June 2016. Germany
3) Li, P., Parsa, A., Huston, S. and Kashyap, A. (2015) *The international competitiveness of Chinese construction firms*. Presentation at the European Real Estate Society 22nd Annual Conference. 24-27th June 2015. Turkey

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Appendix I: List of respondents

List of the experts for the Modified Delphi interviews							
Top 100 Chinese construction firms				**Non-top 100 Chinese construction firms**			
Name	**Position**	**Company**	**Interview time and method**	**Name**	**Position**	**Company**	**Interview time and method**
1.Mr A	Assistant Manager of project management department	T1 Corp.	1st: 15/02/2016 2nd: 21/11/2016 Wechat	15. Mr O	Manager of Overseas Engineering Department	NT1 Group	1st: 06/07/2016 2nd: 02/11/2016 Wechat
2.Mr B	Manager of project management department	T2 Corp.	1st: 21/02/2016 2nd: 23/11/2016 QQ	16. Mr P	Senior Engineer	NT2 Ltd.	1st: 08/07/2016 2nd: 31/10/2016 Wechat
3.Mr C	Assistant manager of investment department	T2 Corp.	1st: 23/02/2016 2nd: 06/11/2016 QQ	17. Mr Q	Assistant manager of marketing department	NT3 Ltd.	1st: 10/07/2016 2nd: 27/10/2016 Wechat
4.Mr D	Assistant manager of overseas marketing department	T2 Corp.	1st: 26/02/2016 2nd: 14/11/2016 Wechat	18. Mr R	Assistant manager of international marketing consultant department	NT4 Ltd.	1st: 12/07/2016 2nd: 18/11/2016 QQ
5. Mr E	Manager of overseas marketing department	T2 Corp.	1st: 02/03/2016 2nd: 09/11/2016 Wechat	19. Mr S	Manager of international cooperation department	NT5 Company	1st: 14/07/2016 2nd: 04/11/2016 Wechat
6. Mr F	Manager of marketing development department	T2 Corp.	1st:03/03/2016 2nd :10/11/2016 Wechat	20. Mr T	Manager of project management department	NT6 Group	1st: 15/07/2016 2nd: 25/11/2016 QQ
7. Mr G	Senior Engineer	T2 Corp.	1st: 08/03/2016 2nd:24/10/2016 QQ	21. Mr U	Assistant manager of technology department	NT7 Corp.	1st: 19/07/2016 2nd: 08/11/2016 Wechat
8. Mr H	Senior Engineer	T3 Corp.	1st: 11/03/2016 2nd:24/11/2016 Wechat	22. Mr V	Assistant manager of project department	NT7 Corp.	1st: 20/07/2016 2nd: 08/11/2016 Wechat

9. Ms I	Senior Engineer	T2 Corp.	1st: 18/03/2016 2nd: 05/12/2016 Wechat	23. Ms W	Assistant manager of marketing department	NT7 Corp.	1st: 21/07/2016 2nd: 11/11/2016 Wechat
10. Ms J	Assistant manager of marketing department	T4 Corp.	1st: 22/03/2016 2nd: 22/11/2016 Wechat	24. Mr X	Manager of project department	NT8 Corp.	1st:24/07/2016 2nd: 25/10/2016 Wechat
11. Mr K	Assistant manager of project management	T2 Corp.	1st: 24/03/2016 2nd: 23/11/2016 Wechat	25. Mr Y	Manager of project department	NT9 Corp.	1st: 26/07/2016 2nd: 05/11/2016 QQ
12.Mr L	Assistant manager of project management	T1 Corp.	1st: 30/03/2016 2nd: 06/12/2016 QQ	26. Mr Z	Manager of project department	NT10 Group	1st: 29/07/2016 2nd: 27/10/2016 Wechat
13. Mr M	Assistant manager of project management	T2 Corp.	1st: 05/04/2016 2nd: 07/12/2016 QQ	27. Mr AA	Manager of project department	NT11 Group	1st: 01/08/2016 2nd: 18/11/2016 QQ
14.Mr N	Manager of project department	T5 Group	1st: 08/04/2016 2nd: 03/11/2016 QQ	28. Ms AB	Assistant manager of marketing department	NT7 Corp.	1st: 04/08/2016 2nd: 01/12/2016 Wechat
Academic scholars							
29. Lecturer AC	U1 College		1st: 09/08/2016 2nd: 30/11/2016 Wechat	31. Professor AE	U3 University		1st: 28/09/2016 2nd: 16/11/2016 Face-to-face
30. Lecturer AD	U2 University		1st: 08/09/2016 2nd: 05/12/2016 Wechat	32. Senior Lecturer AF	U4 University		1st: 12/10/2016 2nd: 09/12/2016 Face-to-face
List of the experts for structured interviews							
33. Mr AG	Technology manager	C1 Corporation	07/08/2017 Face-to-face				
34. Mr AH	Senior engineer	C2 Power station	29/08/2017 Face-to-face				

Appendix II: Modified Delphi interviews questionnaire

First round of interviews

The International Competitiveness of Chinese Construction Firms

Research aim:

The aim of this research is to investigate factors influencing the competitiveness of Chinese construction firms in the global market.

This questionnaire is targeted at senior construction firms' managers who possess a rich knowledge and experience in international construction firms' operations in overseas markets, and individual detailed opinions about the current issues concerning international and Chinese construction firms in the competitive global market.

We are interested in your views as a senior expert, therefore, your comments will be of particular value to the successful outcome of this project. It has been estimated that the process will take about 30-45 minutes. (I should be inclined to use author instead of we, as it is you doing the research)

Instructions:

- This questionnaire is the first of up to three interviews that you will be asked to complete. Once I have received responses from all panellists, I will collate and summarise the findings and formulate a second questionnaire. You should receive this over the next few weeks, and you will have the opportunity to revise your answers in subsequent rounds of the interview.
- In these interviews, you will be asked to develop priorities from the key competitiveness indicators. Most of the questions can be answered with only a single answer.
- If you are not clear about any of the questions, please ask the interviewer.

Confidentiality:

All information you provide will be strictly confidential to the researcher and will not be divulged to any outside party, including other panellists.

Thank you for your time and effort in helping us

General information

Name: Company:

Questionnaire

1. **Table 1 below represents the key competitiveness indicators that were identified through my literature review. Please answer the following questions first and then assess the importance value of each indicator on a 5-point scale which is related to a construction firm's international competitiveness:**

- ***In your view, what are the current issues affecting international and Chinese construction firms' entry into the overseas market?***

- ***In your view, how would you evaluate whether a construction firm is successful or unsuccessful in the international market?***

- ***In your view, how do top international and Chinese construction firms operate successfully in the changing global market?***

Table 1: Key competitiveness indicators rating

Key Competitiveness indicators	**1** **Not important**	**2** **Somewhat important**	**3** **Neutral Important**	**4** **Important**	**5** **Highly important**
Corporate strategies					
1. Quality					
2. Construction safety and environmental safeguards					
3. Social responsibility					
4. Communication and co-operation					
5. Corporate culture					
6. High productivity					
7. Value-added for stakeholders					
8. Reputation					
Organisational capabilities					
9. Organisational management					
10. Technology management					
11. Corporate experience					
12. Employee management					
13. Risk management					
14. Research and Development					
15. Information technology					
Financial capability					
16.Costs					
17.Assets					
18.Revenue					
19. Source of finance					
20.Liability					
21. Profit					

2. **What additional indicators do you consider could contribute to a construction firm's international competitiveness? Please list below and their importance level will be rated in the next round of interviews.**

Table 2: Additional competitiveness indicators

Key Competitiveness indicators	**1** **Not important**	**2** **Somewhat important**	**3** **Neutral Important**	**4** **Important**	**5** **Highly important**

Second round of interviews questionnaire

The International Competitiveness of Chinese Construction Firms

Research aim:

The aim of this research is to systemically investigate the performance of Chinese construction firms in the global market in order to identify the reasons for their success in responding to the changing conditions in the global construction market.

This questionnaire is targeted at construction industry's experts who have rich knowledge and experience of international construction firms' operations in overseas markets, and individual deep opinions about the current issues of international and Chinese construction firms in the competitive global market.

We are interested in your views as a construction industry's expert, therefore your comments will be of particular value to the successful outcome of this project. We estimate that the interview will take about 30-45 minutes per round.

Instructions:

- This is the second round of interviews based on the results of first round of interviews with the same questionnaire. Once I have received responses from all panellists, I will collate and summarise the findings and formulate the third questionnaire if required. You should receive this in the next few weeks, and you will have the opportunity to revise your answers in subsequent rounds of interviews.
- In these interviews, you will be asked to rate the importance of key competitiveness indicators. Most of the questions can be answered with only a single answer.
- If you are not clear about any of the questions, please ask the person who is conducting the interview for clarification.

Confidentiality:

All information you provide will be strictly confidential to the researcher and will not be divulged to any outside party, including other panellists.

Thank you for your time and effort in helping us

General information

Name:

Company:

Questionnaire

1. Pleased rated the degree of importance of key competitiveness indicators based on the results of first round interviews, and explain the reasons for your ratings.

Table 1: Key competitiveness indicators rating

KCIs	Maximum	Minimum	Mean	Median	SD	Rating
1.Quality	5	4	4.781	5	0.420	
2.Social responsibility	5	1	3.906	4	0.856	
3.High productivity	5	3	4.375	4	0.609	
4. Construction safety and environmental safeguards	5	3	4.563	5	0.564	
5.Valued-added for stakeholders	5	2	3.719	4	0.924	
6.Reputation	5	3	4.531	5	0.621	
7.Research and Development	5	2	4.313	4	0.780	
8.Orgarnasational management	5	3	4.500	5	0.622	
9. Corporate experience	5	3	3.906	4	0.588	
10.Communication and cooperation	5	2	3.813	4	0.821	
11.Corporate culture	5	3	3.875	4	0.554	
12. Technology management	5	3	4.438	4	0.564	
13. Employee management	5	2	4.063	4	0.759	
14.Risk management	5	3	4.281	4	0.581	
15.Information technology	5	3	4.063	4	0.669	
16.Assets	5	3	3.938	4	0.759	
17.Costs	5	2	4.125	4	0.707	
18.Revenue	5	2	4.000	4	0.672	
19.Source finance	5	2	3.875	4	0.707	
20. Liability	5	2	3.531	4	0.718	
21.Profit	5	3	4.094	4	0.689	

2. The additional key competitiveness indicators, which respondents proposed in the first round of interviews, please rate their degree of importance and explain the reasons of your rating.

Table 2: Additional competitiveness indicator

Key Competitiveness indicators	**1 Not important**	**2 Somewhat important**	**3 Neutral**	**4 Important**	**5 Highly important**
1.The ability of information acquisition					
2.China's political influence					
3. The relationship between China and other countries					
4. Nation's protectionism					
5.Safety management					
6. The financing methods					
7. Bidding price					
8. Costs control					
9. Project warranty					
10. The national policy					
11. The level of internationalisation					
12. Understanding the international construction market					
13. The guarantee of project quality					
14. The ability of applying advanced technologies and improving existing technologies					
15. The choice in the selection of construction technology in the preliminary construction scheme					
16. Leadership					
17. The training and welfare of expatriate personnel					
18. Contract management					
19. Information management					
20. The ability to deal with project claim					
21. Knowledge of the project countries' accounting and tax systems					
22. Employees' quality					
23. Employee localisation					
24. Company's qualification					
25. The strategy of bidding and the types of payment					
26. The political environment of project countries					
27.Agility/adaptability/responses					
28. Management change					
29. Regulations and legal framework					
30. Understand local values and idiosyncrasies					
31. Corporate knowledge					
32. Brand					

Appendix III: Case study structured interview questionnaire

The international competitiveness of the China General Nuclear Power Group:

Hinkley Point C, a case study

Real Estate and Land Management School (RELM)

Royal Agricultural University

Cirencester, GL7 6JS, UK

Tel: 0044 773 971 0085

Email: puying.li@student.rau.ac.uk

Hinkely Point C nuclear power station (HPC) is a new European generation nuclear power station, located in Somerset, England, to be operated by Electricite de France (EDF) and its Chinese partner China General Nuclear Corporation (CGN). HPC has attracted much critical attentions from its inception and proposed operation, there are:

1) Cost overruns: the projected budget has been increased from an £18 billion estimate to £20 billion

2) Time delays: the completion date is expected to be 2027 rather than 2025

3) Safety: a problem with the carbon concentration in the steel; radioactive pollution could affect the surrounding environment; employees' safety in the construction and the station's operation

4) National policy: British taxpayers are locked in to paying costs of £30 billion for HPC's power via energy bills for 35 years; moreover, the UK government is concerned with national security if a Chinese company is involved in such a huge nuclear power project; furthermore, Brexit could affect this project's progress.

However, when assessing this construction project's success or otherwise focus should not only be on these four issues. Thus, the competitiveness framework, which has been established by the Modified Delphi method, will be applied to this case study. The Modified Delphi Method obtains the most reliable consensus of opinions from a group of experts with respect to the key Competitiveness Indicators (KCIs) which will influence the Chinese construction firm's international competitiveness. Therefore, the interview questions were designed with regard to the competitiveness framework, in order to:

1) Understand the HPC's current issues and CGN's operational performance concerning this project

2) To test the viability of the competitiveness framework

Please answer the questions and rate the KCIs on a five-point scale (1=not important, 5=very important) based on CGN's operational performance concerning HPC. You do not need to rate all the indicators, please select the appropriate indicators, which could illustrate CGN's competitiveness relating to this project.

Thank you for your time and effort in helping us

Competitiveness framework			Questions	Rating
Clusters	**Factors**	**KCIs**		
Project operation	Quality	KCI-1 Project quality	A problem faced by HPC at present is the carbon concentration in the steel. However, this would not prevent the start of HPC's reactor construction next year, what do you think about the HPC's quality?	
		KCI-34 Quality assurance	The Nuclear Installation Act is applied to HPC, do you think the standards of quality assurance is helpful for control of HPC's quality? Additionally, do you think that the CGN has the ability to meet the quality assurance standards for HPC?	
		KCI-30 Project warranty	Do you think it is important that EDF and CGN supply a project warranty for HPC in order to ensure HPC's quality and safety after HPC transfers to the UK government?	
	Safety and health	KCI-3 Construction safety and environmental safeguards.	One of the key safety and environmental issues relating to a nuclear power station is radioactive waste. EDF and CGN have a set of comprehensive radioactive waste management mechanisms and environmental monitoring systems. However, local people are still concerned about any radioactive pollution that could affect HPC's surrounding environment. What are your views concerning HPC's possible radioactive pollution? Do you think this factor could affect surrounding residents' safety or not?	
		KCI-26 Safety management	The EDF's EPR reactors in Flamanyyille has encountered safety problem this year, causing five people to be treated for smoke inhalation. However, Daya Bay was CGN's first nuclear power station, which opened in 1994, and has been internationally recognised as having one of the best safety records in the world, and CGN has never encountered safety problems with its nuclear power projects. Now, EDF and CGN together will undertake HPC, CGN has said that nuclear safety is paramount as their baseline for HPC. EDF has said that safety in HPC was of the utmost importance to both EDF and CGN. What are your views about their safety management declarations in relation to HPC so far?	
	Technology	KCI-35 The ability to of apply advanced technologies	CGN's own nuclear technology HPR 1000 reactor will be applied at Bradwell B after HPC's completion. CGN is confident that the HPR 1000 will meet the UK's stringent safety, security and design requirements. What are your views concerning the application of Chinese advanced nuclear technology in the UK? Is it important for a Chinese construction company to enter the UK market?	
		KCI-36 The choice of selection of construction technology in the	A technology application scheme is deemed an effective way to further construction management. Do you think is it important that EDF and CGN plan their construction technology programme first and then to plan	

		preliminary construction scheme	the HPC construction scheme, in order to ensure the application of the appropriate technology at each construction stage?	
		KCI-5 Technology management	Do you think technology management is important in HPC? Do EDF and CGN's possess the ability to implement appropriate technology management at HPC now?	
	Contract	KCI-39 Contract management	How successful are EDF and CGN's contract management performance at HPC now? Do they pay attention to contract management, especially, the contract signed with subcontracts, suppliers and employees?	
	Productivity	KCI-10 High productivity	In such a huge project, do you think is it important that the construction teams have high productivity objectives to complete their tasks daily? Otherwise the project could face further delays or quality problems.	
Corporate strategies	Development strategies	KCI-12 Reputation	Do you think CGN's reputation is one of the important indicators to facilitate its entry in to the UK market, and in securing the HPC project?	
		KCI-53 Brand	HPR1000 was researched and produced by CGN, HPR1000 is one of the brands for CGN, it has been used in a nuclear project in China and it will be applied at Bradwell B. Do you think brand is important for CGN in the UK market?	
		KCI-16 Risk management	HPC faces many risks since it started to plan construction, such as cost overruns, time delays, and potential risks after Brexit and project safety. What are your views of EDF and CGN's risk management so far?	
		KCI-32 The level of internationalisation	CGN established its new company called General Nuclear International in the UK, and has already sent Chinese technology experts to HPC. Do you think it important that CGN improves its internationalisation to meet the UK market?	
		KCI-7 Communication and cooperation	EDF established a community hub near HPC in order to share its news, and construction plans to communicate with people who were interested in HPC. CGN said that it was important to communicate with the public and other stakeholders, such as opinion leaders, staff, local people and organisations. However, there is no evidence to show that CGN is providing communications concerning HPC so far. What are your views of this? Do you think is it important that construction firms communicate with the public?	
		KCI-11 Value-added for stakeholders	CGN is committed to delivering safe, cost efficient, and sustainable energy, and to support the UK's goal of becoming a low-carbon society; the economic benefits of China's investment in the UK's new nuclear plants will be shared among businesses and workers across the country. How far do you think CGN promotes these values in the UK?	

	Bidding	KCI-28 Bidding price	Because EDF sought CGN's investment to cover the 33.5% stake, CGN was not involved in the bidding to undertake HPC. Thus, the bidding factors could be ignored in this case.	
		KCI-46 The strategy of bidding		
	Talent strategies	KCI-43 Employees' quality	What do you think about HPC's employee quality? CGN sent some Chinese nuclear technology experts to work at HPC, they are the top nuclear experts in China. Do you think the employee quality is important?	
		KCI-44 Employee localisation	Do you think is it important that local employees should be recruited to work at HPC?	
		KCI-38 The training and welfare of expatriate personnel	CGN said that it had developed its training system for employees in order to improve employees' knowledge and skills. Does the training system work? Does an expatriate gain enough knowledge from the training system? Do expatriates receive appropriate welfare support?	
	External coordination ability	KCI-51 Understanding local values and idiosyncrasies	Cultural differences could cause a barrier in respect of entry. When CGN operates projects in the UK, do you think is it important that CGN understands the UK's local values and idiosyncrasies?	
		KCI-4 Social responsibility	CGN said that it would benefit the UK with respect to jobs, skills, supply chains, consumers and the environment. What are your views concerning CGN's social responsibility in the UK?	
Organisation capabilities	Behavioural capability	KCI-2 Organisational management	CGN has detailed departments at its headquarters, and approximately 40 subsidiaries in different business areas, CGN established its UK offices in order to operate HPC and any future investment in the UK. Do you think a firm's organisational management is important for its overseas business?	
		KCI-49 Management change	The culture, values and idiosyncrasies are different between China and UK. Do you think is it necessary CGN change its management style to meet British consumers and partners, and in its management of British employees?	
		KCI-37 Leadership	In this huge HPC project, do you think the leadership is significant?	
		KCI-14 Employee management	HPC will create over 25,000 employee positions; do you think EDF and CGN will provide the appropriate training and welfare for employees?	
		KCI-48 Agility/adaptability/responses	Do you think it should be significant for CGN to adapt to British culture and values, and could quickly respond to the UK market when it undertakes the HPC project?	
	Knowledge capability	KCI-33 Understanding the international construction market	Do you think is it important that CGN understands the UK construction market when it undertakes HPC, although this project is mainly operated by EDF, with CGN only covering 33.5% of the stake?	
		KCI-52 Corporate knowledge	CGN has top nuclear experts in China and 400 copyrights; do you think corporate knowledge is important when applied to HPC, and important for its expansion in the UK market?	

		KCI-17 Research and Development	CGN has more than 2000 R&D staff and has currently 13 R&D projects. What are your views concerning CGN's research and development in HPC? Could CGN's research and development ability ensure HPC's quality?	
		KCI-9 Corporate culture	What are your opinions about a firm's culture? Do you think CGN's corporate culture could facilitate its HPC operation and its business in the UK market?	
		KCI-6 Corporate experience	CGN has rich experience in nuclear power station construction and operations, and CGN and EDF have worked together in close cooperation for 30 years to develop nuclear power in China. Do you think their experience is necessary for their cooperation in HPC and for future projects in the UK?	
	Information management capability	KCI-22 The ability of information acquisition	Do you think is it important for CGN to have the ability to acquire the UK's market information in order to operate successfully at HPC and other nuclear projects in the UK?	
		KCI-40 Information management	CGN is to build an up-to-date data centre that improves a network's performance while delivering energy efficiency, network reliability, and scalability. What do you think about CGN's information management systems at HPC currently?	
		KCI-21 Information technology	What are your views concerning CGN's information technology at HPC?	
Financial capabilities	Accounting	KCI-20 Profit	What are your views concerning HPC's profits relating to CGN?	
		KCI-8 Costs	The budget of HPC has risen from £18 billion estimated last year to £20 billion, of which EDF invested 66.5% and CGN covered 33.5%. Do you think this cost is too high? Do you think it has a competitive advantage when a construction firm has the ability to finance the project?	
		KCI-15 Revenue	Taxpayers are locked in to paying costs of £30 billion for HPC's power via energy bills for 35 years, the equivalent of £15 on the average annual bill. However, if alternative low-carbon sources of power, such as wind, and solar became cheaper, do you think is it reasonable that EDF and CGN obtain their revenue from taxpayers paying this expensive energy bill?	
		KCI-13 Assets	CGN's total assets were estimated at RMB ¥430.7 billion and net assets were RMB ¥129.6 billion. Do you think its assets are significant for the HPC operation, and expansion in to the UK market in the future?	
	Management and resourcing	KCI-29 Cost control	At present, HPC's costs are increasing from £18 billion to £20 billion, what are your views of EDF and CGN's cost control?	
		KCI-27 Financing methods	EDF owns two-third of HPC and CGN owns a third, concerning CGN's investment, Taian Lurun agreed to invest ten per cent of the total Chinese equity amounting to £6.03 billion Pounds into HPC. What are your views of	

			this financing method? Do you think this financing method is the good way to invest in HPC? Do you think any other financing method could be better employed for investment in HPC?	
		KCI-42 Knowledge of the project countries' accounting and tax systems	Do you think it is important for CGN to have knowledge of the UK's accounting and tax systems for the HPC operation?	
		KCI-18 Source of finance	The State-owned Assets Supervision and Administration commission of the state council holds a share of 90% in CGN, and Guangdong Hengjian Investment Holding Co., on behalf of the Guangdong Provincial Government, and holds a share of 10% of CGN. At HPC, CGN has agreed to cooperate with Taian Lurun Co., Ltd. which has 10% of CGN's stake in HPC. What are your views concerning CGN's sources of finance? Do you think these sources of finance encourage EDF and the UK government in favour of CGN?	
Policies	Diplomacy	KCI-24 The relationship between China and other countries	Do you think the relationship between the UK and China is one of key elements to promote CGN's undertaking in HPC? What is your view concerning the proposed scrapping of Hinkley Point C? A comment in The Times considered that if the cancellation initiative came from China, it was possible that some new arrangement could be salvaged from the certain wreckage of the EDF scheme, without seriously damaging both economic prospects, and Britain's relationship with China.	
	National policy	KCI-31 National policy	China's policy is to "go global", successive UK governments have argued that nuclear power was a necessary part of the UK's generation mix, and now, the UK is seeking new policies to promote the national economy after Brexit. Do you think the national policy will influence HPC and CGN's operations in HPC?	
	Political environment	KCI-23 China's political influence	What are your views concerning China's political influence in the world now? Do you think the UK government should sign nuclear contracts with China because of China's growing status in the world?	
		KCI-47 The political environment of project countries	Do you think the UK's political environment could affect CGN's operation in HPC, especially, post-Brexit?	

	Industrial regulations	KCI-50 Regulations and legal frameworks	The UK has a state of the art supervisory regime and legal system. Its regulatory authorities are experienced and adequately resourced to ensure the safety of nuclear plants. EDF and CGN are subjecting themselves to both international and British standards. What are your views relating to the UK's regulations and legal framework in construction or in nuclear construction? Do you think is it possible that China and the UK could establish construction regulations together in order to strengthen two countries' cooperation in construction?	

Appendix IV: Top 100 international contractors ranking over past decades, showed in their ranking position

Company names	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
HOCHTIEF	1	1	1	1	1	1	1	1	2	2	2
SKANSKA	2	2	2	3	4	6	5	9	9	8	8
KRB	3	6	8	15	13	12	14	18	29	40	45
VINCI	4	3	3	2	2	2	2	3	4	4	4
BECHTEL	5	7	6	6	5	4	3	5	3	3	3
BOUYGUES	6	5	5	5	6	5	4	8	7	7	7
TECHNIP	7	9	7	8	9	10	9	11	11	10	6
STRABAG	8	4	4	4	3	3	8	4	6	6	9
ROYAL BAM GROUP	9	11	11	12	15	17	17	19	19	18	19
BILFINGER BERGER AG	10	10	9	9	8	8	13	14	16	16	**
FERROVIAL	11	12	25	35	34	34	30	**	**	14	15
FLUOR	12	8	10	11	11	9	7	7	5	5	12
AMEC PLC	13	14	71	85	98	177	185	176	142	193	173
LEND LEASE GROUP	14	13	12	10	10	14	16	38	33	35	33
GRUPO ACS	15	16	17	19	20	18	12	2	1	1	1
JGC CORP	16	15	15	25	46	51	35	29	32	27	28
CHINA STATE CONSTRUCTION ENG'G	17	20	18	21	25	22	20	22	24	20	17

CONSOLIDATED CONTRACTORS	18	17	13	16	19	19	18	17	21	24	22
SNAMPROGETTI	19	27	**								
KAJIMA	20	23	23	24	24	33	46	44	50	54	53
CONSTRUTORA NORBERTO	21	21	21	20	18	15	15	13	12	12	13
EIFFAGE	22	26	26	**	26	30	37		**	42	41
FOSTER WHEELER	23	32	27	22	21	20	28	31	44	55	**
BALFOUR BEATTY	24	19	20	14	16	16	19	16	17	**	**
CEGELEC	25	24	31	42	**						
PCL	26	22	19	31	44	43	60	27	22	22	25
CHIYODA CORP	27	18	16	17	29	61	70	69	65	44	39
OBAYASHI	28	28	32	23	22	45	49	51	47	45	35
TAISEI	29	31	24	36	35	47	62	60	76	90	103
TOYO ENGINEERING	30	39	40	26	40	67	76	72	57	70	60
HYUNDAI ENGINEERING	31	54	43	59	52	23	23	25	15	13	14
JACOBS	32	30	28	40	45	52	72	61	55	56	51
IMPREGILO	33	36	33	41	38	40	50	49	**	**	**
AKER KVAERNER	34	25	**								
TECHINT	35	40	37	43	39	27	38	37	**	**	**
TAKENAKA	36	35	35	49	63	83	96	74	70	88	77

JOANNOU & PARASKVAIDES	37	41	45	45	36	37	51	70	73	81	79
PETROFAC	38	29	29	30	27	24	22	20	18	21	21
CHINA HARBOUR ENGINEERING	39	**									
TECNIMONT SPA	40	**									
CB&I	41	38	34	29	23	38	43	35	37	26	24
SHIMIZU CORP	42	37	39	52	50	55	79	80	67	75	75
OHL SA	43	34	30	28	32	**	21	21	23	31	31
FCC	44	44	22	13	12	11	10	12	14	36	**
WASHINGTON GROUP INTERNATIONAL	45	52	65	**							
LEIGHTON HOLDINGS LTD	46	48	41	51	48	21	25	28	31	33	29
CHINA NATIONAL MACHINERY & EQUIP	47	**									
CHINA RAILWAY ENGINEERING CORP	48	67	67	71	62	53	33	39	34	28	23
ASTALDI	49	57	59	58	74	65	65	59	62	62	55
TAIKISHA	50	46	62	79	89	112	102	90	75	91	**
BESIX SA	51	49	46	47	49	48	52	78	63	69	73
ENKA CONSTRUCTION & INDUSTRY	52	47	44	37	37	50	88	95	79	52	65
SAMSUNG ENGINEERING	53	**	49	46	53	35	34	15	13	15	**
VEIDEKKE	54	55	60	61	**	104	101	96	**	**	**
NISHIMATSU CONSTRUCTION	55	59	133	138	124	74	182	128	166	155	**

SOLETANCHE BACHY	56	56	50	**							
TECNICAS REUNIDAS	57	63	47	27	42	29	31	33	38	38	32
CHINA PETROLEUM ENG'G	58	60	70	76	100	46	27	48	84	76	66
CENTEX	59	75	**								
SAMSUNG CORP	60	74	48	69	75	72	56	63	36	17	16
ABB LUMMUS GLOBAL	61	69	108	**							
GRINAKER-LTA LTD	62	**									
ORASCOM CONSTRUCTION INDUSTRIES	63	**	53	77	41	88	94	111	141	67	40
GAMA	64	65	64	60	66	68	75	94	118	206	133
DAEWOO E&C	65	**	58	63	67	54	57	50	40	49	43
WORLEYPARSONS	66	92	109	108	139	127	121	108	69	65	56
ACCIONA SA	67	43	**	34	73	70	66	54	49	60	61
SHANGHAI CONSTR. (GROUP) GENERAL	68	64	73	90	103	89	54	86	96	129	100
CHINA CIVIL ENGINEERING CONSTR	69	76	82	100	72	86	86	91	71	71	47
TRACTEBEL ENGINEERING	70	89									
RIZZANI DE ECCHER SPA	71	81	84	98	116	126	126	156	184	160	130
EARTH TECH	72	87	107	116	**						
PENTA-OCEAN CONSTRUCTION CO.LTD	73	80	78	92	78	90	87	87	80	97	87
ED ZUBLIN AG	74	58	63	53	69	81	84	82	74	87	88

E. PIHI	75	78	74	83	97	**					
MAEDA CORP	76	**	99	104	**	**					
PERINI CORP.	77	110									
THE SHAW GROUP INC.	78	109									
SKE GROUP	79	82	89	87							
KIEWIT CORP	80	61	66	56	55	49	42	43	39	37	36
SINOHYDRO	81	68	51	50	56	41	24	23	20	23	11
CONSTRUCTION ANDRADE GUTIERREZ SA	82	91	106	128	96	77	85	76	66	77	83
KUMAGAI GUMI CO. LTD	83	103									
CHINA ROAD & BRIDGE CORP.	84										
NATIONAL PETROLEUM CONSTRUCTION	85	133	76	73	79	121	124	149	224	250	201
BAUER AG	86	79	77	89	91	110	109	112	100	106	97
ARABIAN CONSTRUCTION CO	87	66	57	62	71	66	68	75	68	99	95
THE ARAB CONTRACTORS	88	100	113	117	121	115	103	102	83	105	85
SOLEL BONEH INTERNATIONAL	89	83	92	93	107	**					
CTCI CORP	90	105	110	88	86	92	134	116	109	131	122
SOARES DA COSTA GROUPO	91	95	81	96	108	103	104	105	108	125	**
TEKFEN CONSTRUCTION	92	90	69	75	82	97	110	88	85	101	90
QUATTROGEMINI	93	106									

CH2M HILL	94	119	105	99	117	136	160	192	226	236	**
CLOUGH LTD	95										
HAZAMA	96	101									
BLACK & VEATCH	97	98	86	65	92	122	137	118	102	120	135
SUMITOMO MITSUI CONSTRUCTION CO. LTD	98	118									
SADE-CGTH	99	115									
ALARKO CONTRACTING GROUP	100	126									
SACYR VALLEHERMOSO	**	33	38	44	64	64	45	55	58	61	71
GS ENGINEERING	**	42	52	64	68	63	48	32	28	29	26
CHINA COMMUNICATION CONSTRUCTION	**	45	14	18	17	13	11	10	10	9	5
CHINA NATIONAL MACHINERY	**	50	55	48	28	26	26	24	25	25	27
PARSONS	112	51	87	207	209	211	215	**	**	**	**
ABEINSA	**	53	54	54	58	39	40	26	30	19	20
LARSEN & TOUBRO LTD	**	62	72	67	60	62	77	58	48	47	57
GROUP MOTA-ENGIL	**	70		74		**	73	**	59	59	54
JOHN SISK& SON LTD	**	71	79	91	129	165	108	98	115	**	**
SEMBCORP ENGINEERS AND CONSTRUCTIONS	**	72									
CHINA RAIWAY CONSTRUCTION CORP	167	73	83	102	51	25	29	30	53	39	58
CONTRACK INTERNATIONAL	**	77									

SK ENGINEERING & CONSTRUCTION	104	84	68	66	81	94	63	45	35	43	42
GHELLA SPA	106	85	80	82	105	91	105	103	107	110	119
RENAISSANCE CONSTRUCTION	**	86	61	68	85	75	69	81	64	53	37
YUKSEL INSAAT CO	**	88	85	101	110	107	122	120	124	132	123
CHINA METALLURGICAL	101	93	95	81	61	31	61	42	51	68	49
CHINA NATIONAL CHEMICAL	102	94	88	97	90	124	92	77	82	82	76
KINDEN	109	96	**	126	144	154	156	185	178	177	202
CHINA INT'L WATER & ELECTRIC	103	97	97	110	122	125	115	92	86	84	74
SALINI CONSTRUCTION SPA	119	99	75	70	84	71	90	71	27	34	30
MCDERMOTT	**	**	36	32	33	28	47	34	42	**	**
JAN DE NUL	**	**	42	39	43	44	53	52	**	**	46
MAIRE TECHNIMONT	**	**	56	33	31	36	39	36	52	78	80
ZHONGYUAN PETROLEUM	**	**	90	94	112	123	118	99	116	137	127
PJSC STROYTRANSGAZ	**	**	91	124	111	95	144	180	222	**	
GRUPO ISOLUX		**	93	78	88	56	44	47	45	41	63
BAYTUR CONSTRUCTION	179	116	94	109	125	158	150	**			
C.M.C. DI RAVENNA	114	102	96	119	135	129	128	121	128	114	105
CITIC CONSTRUCTION CO LTD	110	108	98	72	59	32	32	46	43	46	52
THE CONTRACTING & TRADING CO		104	100	95	87	98	111	115	130	144	132

SAIPEM		**	**	7	7	7	6	6	8	11	10
DANIELI			**	38	30	**	36	41	41	50	50
PUNJI LLOYD LTD			**	55	57	58	82	79	77	92	
IBERDOLA INGENIERIA Y CONSTRUCTION			**	57	65	59	74	113	106	113	**
URS CORP			**	80	128	153	205	194	93	74	**
HANJIN HEAVY	151	164	114	84	101	196	**				
DONGFANG ELECTRIC		107	138	86	80	80	80	83	92	79	72
KELLER GROUP			**	**	47	**	**				
A. PORR AG				**	54	60	67	73	78	72	70
ANT YAPI CONSTRUCTION		**	**	**	70	93	131	100	94	107	92
ANSALDO ENERGIA SPA			**	106	76	82	93	**	104	108	102
DAELIM INDUSTRIAL				**	77	42	41	40	26	30	34
SHANGHAI ELECTRIC		**	148	145	83	78	78	67	72	64	91
SSANGYONG			**	112	93	99	106	134	132	135	117
SINOPEC ENGINEERING			**	103	94	69	83	114	91	89	84
SEPCOIII			161	142	95	79	58	53	54	58	**
CHINA GEZHOUBA			**	129	99	84	71	62	56	51	44
VAN OORD					**	57	55	57	60	66	69
SNC-LAVALIN				**	**	73	64	68	87	100	68

CHINA PETROLEUM PIPELINE		**	159	118	120	76	89	123	98	63	64
Ellaktor SA					**	85					
POSCO			**	192	115	87	123	66	46	57	59
STFA	122	125	120	149	114	96	117	201	240	230	192
TAV			**	120	102	100	114	106	103	83	82
POLIMEKS				**	159	102	59	56	90	86	62
TREVI SPA				**	104	105	81	119	114	117	**
ANSALDO STS						**	91				
HARBIN POWER ENGINEERING	139	149	102	140	137	108	95	97	**		
ARCHIRODON						**	97				
ABB SPA				**	136	113	98	110	136		
BONATTI SPA			**	151	119	114	99	107	119	134	114
SHANDONG ELECTRIC	105	114	115	107	123	101	100	64	61	102	**
KHARAFI NATIONAL KSCC	118	156	130	188	158	173	141	65	101	213	244
METKA						**	133	84			
COMSA EMTE			**	133	146	139	143	85	97	95	96
CHINA GENERAL TECHNOLOGY							**	89	81	85	93
CGC OVERSEAS CONSTRUCTION		154	137			**	112	93	89	93	86
HANWHA ENGINEERING & CONSTRUCTION CORP								101	88	73	78

QINGJIAN GROUP(QINGDAO)		129	126	135	143	133	127	104	95	98	81
SHIKUN & BINUI - SBI INFRASTRUCTURE LTD								**	99		
NCC AB									**	32	
M+W GROUP GMBH									**	48	48
KENTZ ENGINEERING AND CONSTRUCTION GROUP									**	80	
OAS SA							**	122	121	94	
OZTURK HOLDING										**	18
MCCONNELL DOWELL	115	120	104	113	113	120	116	109	105	190	38
AECOM										**	67
CALIK ENERJI SAANAYI							**	129	111	157	89
SOCIETA ITALIANA PER CONDOTTE D'ACQUA SPA	140	132	146	202	167	178	181	140	112	96	94
SHAPOORJI PALLONJI						**	222	153	125	123	98
KAYSON								**	139	118	99

Source: Author adapted from Engineering News Records: Top 250 international contractors (2005-2015)

Appendix V: The top international contractors who operate in the UK (total 60 companies)

Company's name	Company's name	Company's name	Company's name
HOCHTIEF AG, Germany	SKANSKA AB, Sweden	KELLER GROUP, UK	OHL SA, Spain
KBR, U.S.A	VINCI, France	KENTZ ENGINEERING AND CONSTRUCTION GROUP, UK	TAIKISHA LTD, Japan
BECHTEL, U.S.A	BOUYGUES, France	DANIELI, Italy	SOLETANCHE BACHY, France
TECHNIP, France	ROYAL BAM GROUP, The Netherlands	CLOUGH LTD, Australia	SAMSUNG C&T CORP, S. Korea
BILFINGER BERGER AG, Germany	FERROVIAL, Spain	SAIPEM, Italy	AECOM, U. S. A
FLUOR, U.S.A	AMEC PLC, UK	MAIRE TECNIMONT SPA, Italy	BESIX SA, Belgium
LEND LEASE GROUP, UK	GRUPO ACS, Spain	M+W GROUP GMBH, Germany	TECNICAS REUNIDAS SA, Spain
JGC CORP, Japan	CONSOLIDATED CONTRACTORS, Greece	The CONTRACTING & TRADING CO, Israel	ABB LUMMUS GLOBAL, U.S.A
CONSTRUTORA NORBERTO ODEBRECHT, Brazil	KAJIMA, Japan	SNC-LAVALIN, Canada	ABEINSA, Spain
TRACTEBEL ENGINEERING, Belgium	EIFFAGE, France	WORLEYPARSONS, Australia	PARSONS, U.S.A
CH2M HILL COS. LTD, U.S.A	BALFOUR BEATTY, UK	VAN OORD, the Netherlands	SACYR VALLEHERMOSO, Spain
OBAYASHI, Japan	JACOBS, U.S.A	JAN DE NUL, Luxembourg	BLACK & VEATCH, U.S.A
SALINI IMPREGILO SPA, Italy	AKER KVAERNER ASA, Norway	HANJIN HEAVY, Korean	SHIMIZU CORP, Japan
TAKENAKA CORP, Japan	JOANNOU & PARASKVAIDES, UK	MCDERMOTT, USA	FCC, Spain
PETROFAC, Channel Islands	CB&I, U.S.A	ACCIONA SA, Spain	JOHN SISK& SON LTD, UK

Source: Author adapted from Engineering News Records: Top 250 international contractors (2005-2015)

Appendix VI: The Chinese contractors who rank in top 100 international contractors over the past decades (total 27 companies)

Company's name	Company's name
CHINA STATE CONSTRUCTION ENG'G	CHINA RAILWAY ENGINEERING CORP
CHINA PETROLEUM ENG'G & CONSTR	SHANGHAI CONSTR. (GROUP) GENERAL
CHINA CIVIL ENGINEERING CONSTR	SINOHYDRO CORP
CHINA COMMUNICATION CONSTRUCTION	SEPCO ELECTRIC POWER CONSTRUCTION CORP
CHINA METALLURGICAL GROUP CORP	CHINA NATIONAL CHEMICAL CORP
CHINA RAIWAY CONSTRUCTION CORP	CHINA INTERNATIONAL WATER & ELECTRIC CORP
ZHONGYUAN PETROLEUM	CITIC CONSTRUCTION CO. LTD.
DONGFANG ELECTRIC CORP	SHANGHAI ELECTRIC
SINOPEC ENGINEERING (GROUP) CO. LTD	CHINA GEZHOUBA GROUP CO.LTD.
CHINA PETROLEUM PIPELINE BUREAU	HARBIN POWER ENGINEERING LTD.
SHANDONG ELECTRIC	CHINA GENERAL TECHNOLOGY GROUP
CGC OVERSEAS CONSTRUCTION	QINGJIAN GROUP(QINGDAO)
CHINA HARBOUR ENGINEERING LTD.	CHINA ROAD & BRIDGE CORP.
CHINA NATIONAL MACHINERY & EQUIPMENT IMPORT & EXPORT CORP	

Source: Author adapted from Engineering News Records: Top 250 international contractors (2005-2015)

Appendix VII: First round of Modified Delphi interview results

Figure VII-I: The KCIs rating of each participant

Quality	Safety healthy	Social Resposbility	Communication Cooperation	Corporate Culture	productivity	Value Added	Reputation	Organization Management	Technology Management	Corporate Experience	Employee Management	Risk Management	Research Development	Information	Costs	Assets	Revenue	SourceFina	Liablitily	Profit
4.00	4.00	3.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	5.00	4.00	5.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	3.00	4.00	3.00	2.00	5.00	5.00	5.00	4.00	3.00	4.00	5.00	3.00	4.00	5.00	5.00	5.00	4.00	5.00
5.00	5.00	4.00	5.00	4.00	4.00	3.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	3.00	4.00
5.00	4.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	3.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	3.00	5.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	4.00	3.00	4.00
5.00	4.00	3.00	3.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00
4.00	5.00	3.00	4.00	5.00	5.00	4.00	5.00	5.00	4.00	5.00	3.00	5.00	5.00	4.00	4.00	3.00	3.00	3.00	2.00	3.00
4.00	5.00	3.00	4.00	3.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00
5.00	5.00	5.00	3.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	5.00	3.00	3.00	5.00
5.00	5.00	3.00	3.00	4.00	4.00	2.00	4.00	3.00	5.00	3.00	3.00	5.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	3.00	5.00	4.00	5.00	4.00	4.00	5.00
5.00	5.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00
5.00	5.00	5.00	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	5.00	5.00	4.00	5.00	3.00	3.00	5.00	5.00	3.00	4.00	4.00	5.00	5.00	5.00	3.00	5.00	4.00	3.00	5.00
5.00	4.00	5.00	5.00	4.00	4.00	5.00	4.00	4.00	5.00	3.00	4.00	4.00	4.00	5.00	5.00	3.00	4.00	4.00	3.00	4.00
5.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00
5.00	4.00	4.00	3.00	3.00	5.00	4.00	5.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00
5.00	4.00	4.00	3.00	5.00	4.00	2.00	5.00	5.00	5.00	4.00	5.00	4.00	5.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
4.00	3.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00
5.00	4.00	4.00	3.00	3.00	5.00	5.00	5.00	5.00	4.00	3.00	5.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	5.00	5.00
5.00	5.00	5.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
4.00	4.00	1.00	4.00	3.00	5.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00	5.00	4.00	4.00	5.00	4.00	5.00
5.00	5.00	5.00	3.00	5.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
4.00	5.00	3.00	3.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00
5.00	4.00	4.00	2.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	2.00	4.00	2.00	3.00	2.00	3.00	2.00	4.00
5.00	4.00	5.00	4.00	4.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00
4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00	5.00	4.00	4.00
5.00	5.00	3.00	5.00	4.00	5.00	2.00	5.00	4.00	5.00	5.00	2.00	5.00	4.00	3.00	5.00	5.00	4.00	4.00	4.00	4.00

Figure VII-II: The KCIs' ranking average of each participant

KCI1	KCI2	KCI3	KCI4	KCI5	KCI6	KCI7	KCI8	KCI9	KCI10	KCI11	KCI12	KCI13	KCI14	KCI15	KCI16	KCI17	KCI18	KCI19	KCI20	KCI21
12.50	12.50	20.00	12.50	12.50	12.50	3.50	3.50	3.50	12.50	3.50	3.50	12.50	3.50	12.50	12.50	20.00	12.50	12.50	20.00	12.50
5.50	5.50	13.50	18.50	13.50	18.50	21.00	5.50	5.50	5.50	13.50	18.50	13.50	5.50	18.50	13.50	5.50	5.50	5.50	13.50	5.50
6.00	6.00	15.50	6.00	15.50	15.50	20.50	6.00	6.00	6.00	15.50	6.00	6.00	6.00	6.00	15.50	6.00	15.50	15.50	20.50	15.50
4.00	14.00	14.00	14.00	14.00	4.00	14.00	4.00	4.00	14.00	14.00	14.00	4.00	4.00	4.00	14.00	14.00	14.00	14.00	21.00	14.00
6.00	6.00	15.50	15.50	15.50	6.00	20.50	6.00	6.00	6.00	15.50	6.00	6.00	6.00	6.00	15.50	15.50	15.50	15.50	20.50	6.00
5.00	5.00	14.50	14.50	14.50	14.50	14.50	5.00	5.00	5.00	14.50	5.00	5.00	5.00	5.00	20.50	14.50	14.50	14.50	20.50	14.50
2.50	10.50	19.00	19.00	10.50	10.50	2.50	10.50	2.50	2.50	10.50	10.50	10.50	19.00	10.50	10.50	10.50	10.50	10.50	19.00	19.00
11.50	4.50	17.50	11.50	4.50	4.50	11.50	4.50	4.50	11.50	4.50	17.50	4.50	4.50	11.50	11.50	17.50	17.50	17.50	21.00	17.50
12.00	3.00	20.00	12.00	20.00	3.00	12.00	3.00	12.00	12.00	12.00	12.00	12.00	20.00	12.00	12.00	3.00	12.00	3.00	12.00	12.00
3.00	3.00	13.50	13.50	13.50	13.50	13.50	3.00	13.50	13.50	13.50	13.50	3.00	13.50	13.50	13.50	13.50	3.00	13.50	13.50	13.50
6.50	6.50	6.50	20.00	15.50	6.50	15.50	6.50	6.50	6.50	15.50	6.50	15.50	6.50	6.50	15.50	15.50	6.50	20.00	20.00	6.50
2.50	2.50	16.00	16.00	8.00	8.00	21.00	8.00	16.00	2.50	16.00	16.00	2.50	8.00	8.00	8.00	16.00	8.00	16.00	16.00	16.00
5.00	5.00	15.00	15.00	15.00	5.00	15.00	15.00	5.00	5.00	15.00	15.00	15.00	5.00	21.00	5.00	15.00	5.00	15.00	15.00	5.00
2.50	2.50	11.50	2.50	19.50	11.50	11.50	11.50	11.50	2.50	11.50	19.50	11.50	11.50	11.50	11.50	11.50	11.50	21.00	11.50	11.50
2.50	2.50	2.50	20.50	12.00	2.50	12.00	12.00	12.00	12.00	12.00	12.00	20.50	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
6.50	6.50	6.50	6.50	14.50	6.50	19.00	19.00	6.50	6.50	19.00	14.50	14.50	6.50	6.50	6.50	19.00	6.50	14.50	19.00	6.50
4.00	13.00	4.00	4.00	13.00	13.00	4.00	13.00	13.00	4.00	20.00	13.00	13.00	13.00	4.00	4.00	20.00	13.00	13.00	20.00	13.00
2.50	12.50	12.50	12.50	12.50	12.50	21.00	12.50	12.50	2.50	12.50	12.50	12.50	12.50	2.50	2.50	12.50	12.50	12.50	12.50	12.50
2.00	9.50	9.50	18.50	18.50	2.00	9.50	2.00	9.50	9.50	18.50	9.50	9.50	18.50	18.50	9.50	18.50	9.50	9.50	9.50	9.50
4.00	10.00	10.00	16.50	4.00	10.00	21.00	4.00	4.00	4.00	10.00	4.00	10.00	4.00	16.50	16.50	16.50	16.50	16.50	16.50	16.50
6.50	17.00	6.50	17.00	17.00	6.50	6.50	6.50	6.50	6.50	17.00	6.50	17.00	6.50	17.00	6.50	17.00	17.00	6.50	17.00	6.50
4.00	4.00	14.50	14.50	14.50	4.00	14.50	4.00	4.00	14.50	14.50	14.50	14.50	4.00	14.50	14.50	14.50	14.50	14.50	14.50	4.00
6.00	15.00	15.00	20.00	20.00	6.00	6.00	6.00	6.00	15.00	20.00	6.00	15.00	6.00	15.00	6.00	6.00	15.00	15.00	6.00	6.00
3.50	3.50	3.50	3.50	13.00	13.00	3.50	3.50	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	20.50	13.00	20.50
5.00	5.00	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	5.00	15.50	15.50	15.50	5.00	5.00	5.00	5.00	5.00	5.00
13.50	13.50	21.00	13.50	20.00	4.00	13.50	13.50	4.00	13.50	13.50	13.50	4.00	4.00	13.50	4.00	13.50	13.50	4.00	13.50	4.00
3.00	3.00	3.00	20.50	3.00	12.50	20.50	3.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
13.50	4.00	20.50	20.50	13.50	4.00	13.50	4.00	4.00	4.00	13.50	13.50	4.00	13.50	13.50	13.50	4.00	13.50	13.50	13.50	13.50
1.00	4.50	4.50	19.00	12.00	12.00	12.00	4.50	12.00	12.00	12.00	12.00	4.50	19.00	4.50	19.00	12.00	19.00	12.00	19.00	4.50
3.00	9.50	3.00	9.50	9.50	9.50	17.50	17.50	3.00	9.50	9.50	9.50	3.00	3.00	9.50	17.50	17.50	17.50	17.50	17.50	17.50
15.50	15.50	15.50	5.00	15.50	15.50	5.00	5.00	5.00	15.50	5.00	5.00	15.50	15.50	15.50	5.00	5.00	15.50	5.00	15.50	15.50
5.50	5.50	18.50	5.50	14.00	5.50	20.50	5.50	14.00	5.50	5.50	20.50	5.50	14.00	18.50	5.50	5.50	14.00	14.00	14.00	14.00

Figure VII-III: SPSS report of first round interviews

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Quality	32	100.0%	0	0.0%	32	100.0%
Social Responsibility	32	100.0%	0	0.0%	32	100.0%
High productivity	32	100.0%	0	0.0%	32	100.0%
Safety healthy Environment	32	100.0%	0	0.0%	32	100.0%
Value Added Stakeholders	32	100.0%	0	0.0%	32	100.0%
Reputation	32	100.0%	0	0.0%	32	100.0%
Research Development	32	100.0%	0	0.0%	32	100.0%
Organisational Management	32	100.0%	0	0.0%	32	100.0%
Company Experience	32	100.0%	0	0.0%	32	100.0%
Communication Cooperation	32	100.0%	0	0.0%	32	100.0%
Company Culture	32	100.0%	0	0.0%	32	100.0%
Technology Management	32	100.0%	0	0.0%	32	100.0%
Employee Management	32	100.0%	0	0.0%	32	100.0%
Risk Management	32	100.0%	0	0.0%	32	100.0%
Information Technology	32	100.0%	0	0.0%	32	100.0%
Assets	32	100.0%	0	0.0%	32	100.0%
Costs	32	100.0%	0	0.0%	32	100.0%
Revenue	32	100.0%	0	0.0%	32	100.0%
Source Finance	32	100.0%	0	0.0%	32	100.0%
Liability	32	100.0%	0	0.0%	32	100.0%
Profit	32	100.0%	0	0.0%	32	100.0%

Descriptives

			Statistic	Std. Error
Quality	Mean		4.7813	.07425
	95% Confidence Interval for Mean	Lower Bound	4.6298	
		Upper Bound	4.9327	
	5% Trimmed Mean		4.8125	
	Median		5.0000	
	Variance		.176	
	Std. Deviation		.42001	
	Minimum		4.00	
	Maximum		5.00	
	Range		1.00	
	Interquartile Range		.00	
	Skewness		-1.429	.414

	Kurtosis		.039	.809
Social Responsibility	Mean		3.9063	.15133
	95% Confidence Interval for Mean	Lower Bound	3.5976	
		Upper Bound	4.2149	
	5% Trimmed Mean		3.9653	
	Median		4.0000	
	Variance		.733	
	Std. Deviation		.85607	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		.75	
	Skewness		-1.129	.414
	Kurtosis		2.962	.809
High productivity	Mean		4.3750	.10767
	95% Confidence Interval for Mean	Lower Bound	4.1554	
		Upper Bound	4.5946	
	5% Trimmed Mean		4.4167	
	Median		4.0000	
	Variance		.371	
	Std. Deviation		.60907	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	
	Skewness		-.400	.414
	Kurtosis		-.582	.809
Safety healthy Environment	Mean		4.5625	.09977
	95% Confidence Interval for Mean	Lower Bound	4.3590	
		Upper Bound	4.7660	
	5% Trimmed Mean		4.6042	
	Median		5.0000	
	Variance		.319	
	Std. Deviation		.56440	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	
	Skewness		-.834	.414
	Kurtosis		-.282	.809
Value Added Stakeholders	Mean		3.7188	.16335
	95% Confidence Interval for Mean	Lower Bound	3.3856	

	Mean	Upper Bound	4.0519	
	5% Trimmed Mean		3.7431	
	Median		4.0000	
	Variance		.854	
	Std. Deviation		.92403	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-.434	.414
	Kurtosis		-.465	.809
Reputation	Mean		4.5313	.10984
	95% Confidence Interval for	Lower Bound	4.3072	
	Mean	Upper Bound	4.7553	
	5% Trimmed Mean		4.5903	
	Median		5.0000	
	Variance		.386	
	Std. Deviation		.62136	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	
	Skewness		-.986	.414
	Kurtosis		.045	.809
Research Development	Mean		4.3125	.13794
	95% Confidence Interval for	Lower Bound	4.0312	
	Mean	Upper Bound	4.5938	
	5% Trimmed Mean		4.3819	
	Median		4.0000	
	Variance		.609	
	Std. Deviation		.78030	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-1.063	.414
	Kurtosis		1.014	.809
Organisational Management	Mean		4.5000	.10999
	95% Confidence Interval for	Lower Bound	4.2757	
	Mean	Upper Bound	4.7243	
	5% Trimmed Mean		4.5556	
	Median		5.0000	

	Variance		.387	
	Std. Deviation		.62217	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	
	Skewness		-.857	.414
	Kurtosis		-.178	.809
Company Experience	Mean		3.9063	.10395
	95% Confidence Interval for Mean	Lower Bound	3.6942	
		Upper Bound	4.1183	
	5% Trimmed Mean		3.8958	
	Median		4.0000	
	Variance		.346	
	Std. Deviation		.58802	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		.00	
	Skewness		.007	.414
	Kurtosis		.108	.809
Communication Cooperation	Mean		3.8125	.14506
	95% Confidence Interval for Mean	Lower Bound	3.5166	
		Upper Bound	4.1084	
	5% Trimmed Mean		3.8264	
	Median		4.0000	
	Variance		.673	
	Std. Deviation		.82060	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-.003	.414
	Kurtosis		-.765	.809
Company Culture	Mean		3.8750	.09786
	95% Confidence Interval for Mean	Lower Bound	3.6754	
		Upper Bound	4.0746	
	5% Trimmed Mean		3.8611	
	Median		4.0000	
	Variance		.306	
	Std. Deviation		.55358	
	Minimum		3.00	

	Maximum		5.00	
	Range		2.00	
	Interquartile Range		.00	
	Skewness		-.076	.414
	Kurtosis		.403	.809
Technology Management	Mean		4.4375	.09977
	95% Confidence Interval for Mean	Lower Bound	4.2340	
		Upper Bound	4.6410	
	5% Trimmed Mean		4.4653	
	Median		4.0000	
	Variance		.319	
	Std. Deviation		.56440	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	
	Skewness		-.314	.414
	Kurtosis		-.861	.809
Employee Management	Mean		4.0625	.13424
	95% Confidence Interval for Mean	Lower Bound	3.7887	
		Upper Bound	4.3363	
	5% Trimmed Mean		4.1042	
	Median		4.0000	
	Variance		.577	
	Std. Deviation		.75935	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-.578	.414
	Kurtosis		.386	.809
Risk Management	Mean		4.2813	.10273
	95% Confidence Interval for Mean	Lower Bound	4.0717	
		Upper Bound	4.4908	
	5% Trimmed Mean		4.3125	
	Median		4.0000	
	Variance		.338	
	Std. Deviation		.58112	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.00	

	Skewness		-.096	.414
	Kurtosis		-.415	.809
Information Technology	Mean		4.0625	.11827
	95% Confidence Interval for Mean	Lower Bound	3.8213	
		Upper Bound	4.3037	
	5% Trimmed Mean		4.0694	
	Median		4.0000	
	Variance		.448	
	Std. Deviation		.66901	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		.75	
	Skewness		-.070	.414
	Kurtosis		-.611	.809
Assets	Mean		3.9375	.13424
	95% Confidence Interval for Mean	Lower Bound	3.6637	
		Upper Bound	4.2113	
	5% Trimmed Mean		3.9306	
	Median		4.0000	
	Variance		.577	
	Std. Deviation		.75935	
	Minimum		3.00	
	Maximum		5.00	
	Range		2.00	
	Interquartile Range		1.75	
	Skewness		.107	.414
	Kurtosis		-1.203	.809
Costs	Mean		4.1250	.12500
	95% Confidence Interval for Mean	Lower Bound	3.8701	
		Upper Bound	4.3799	
	5% Trimmed Mean		4.1736	
	Median		4.0000	
	Variance		.500	
	Std. Deviation		.70711	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-.766	.414
	Kurtosis		1.459	.809
Revenue	Mean		4.0000	.11880

	95% Confidence Interval for Mean	Lower Bound	3.7577	
		Upper Bound	4.2423	
	5% Trimmed Mean		4.0347	
	Median		4.0000	
	Variance		.452	
	Std. Deviation		.67202	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		.00	
	Skewness		-.680	.414
	Kurtosis		1.678	.809
Source Finance	Mean		3.8750	.12500
	95% Confidence Interval for Mean	Lower Bound	3.6201	
		Upper Bound	4.1299	
	5% Trimmed Mean		3.8958	
	Median		4.0000	
	Variance		.500	
	Std. Deviation		.70711	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		.75	
	Skewness		-.401	.414
	Kurtosis		.520	.809
Liability	Mean		3.5313	.12688
	95% Confidence Interval for Mean	Lower Bound	3.2725	
		Upper Bound	3.7900	
	5% Trimmed Mean		3.5347	
	Median		4.0000	
	Variance		.515	
	Std. Deviation		.71772	
	Minimum		2.00	
	Maximum		5.00	
	Range		3.00	
	Interquartile Range		1.00	
	Skewness		-.116	.414
	Kurtosis		-.058	.809
Profit	Mean		4.0938	.12181
	95% Confidence Interval for Mean	Lower Bound	3.8453	
		Upper Bound	4.3422	
	5% Trimmed Mean		4.1042	

	Median	4.0000	
	Variance	.475	
	Std. Deviation	.68906	
	Minimum	3.00	
	Maximum	5.00	
	Range	2.00	
	Interquartile Range	1.00	
	Skewness	-.123	.414
	Kurtosis	-.768	.809

Kendall's W Test

Ranks

	Mean Rank
KCI1	5.81
KCI2	7.52
KCI3	12.44
KCI4	13.53
KCI5	13.56
KCI6	9.00
KCI7	13.48
KCI8	7.59
KCI9	8.08
KCI10	8.77
KCI11	13.08
KCI12	11.27
KCI13	10.17
KCI14	9.72
KCI15	11.53
KCI16	11.00
KCI17	12.56
KCI18	12.23
KCI19	12.88
KCI20	15.45
KCI21	11.33

Test Statistics

N	32
Kendall's W[a]	.208
Chi-Square	133.261
df	20
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance

Appendix VIII: Second round of Modified Delphi interview results

Figure VIII-I: The 21 KCIs' rating of each participant

quality	safety and healthy	social responsibility	communication corporation	culture	productivity	value added	reputation	organization management	technology	experience	employee management	risk managment	Research development	information technology	costs	asset	revenue	financial source	liability	profit
4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	3.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	3.00	4.00	4.00	5.00	4.00	4.00	5.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	5.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	3.00	5.00
5.00	5.00	4.00	3.00	4.00	4.00	2.00	5.00	4.00	5.00	3.00	4.00	5.00	4.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00
5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00
5.00	5.00	5.00	4.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	3.00	4.00	4.00	3.00	4.00
5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	5.00	4.00	3.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00
5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00
5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00
5.00	5.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00
5.00	5.00	1.00	4.00	3.00	5.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	3.00	5.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	4.00
5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00
4.00	4.00	4.00	5.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00	5.00	4.00	4.00
5.00	5.00	3.00	3.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00	2.00	4.00	3.00	3.00	4.00	5.00	3.00	4.00	4.00	4.00

Figure VIII-II: The 21 KCIs' ranking average of each participant in the second round of interviews

KCI1	KCI2	KCI3	KCI4	KCI5	KCI6	KCI7	KCI8	KCI9	KCI10	KCI11	KCI12	KCI13	KCI14	KCI15	KCI16	KCI17	KCI18	KCI19	KCI20	KCI21
12.00	2.50	12.00	12.00	12.00	12.00	2.50	2.50	2.50	12.00	12.00	12.00	12.00	12.00	12.00	12.00	20.50	12.00	12.00	20.50	12.00
4.50	4.50	14.00	14.00	14.00	14.00	20.50	4.50	4.50	4.50	14.00	14.00	14.00	4.50	20.50	14.00	14.00	4.50	14.00	14.00	4.50
4.00	4.00	14.00	14.00	14.00	14.00	14.00	4.00	4.00	4.00	14.00	14.00	4.00	14.00	4.00	14.00	14.00	14.00	14.00	21.00	14.00
3.00	3.00	13.00	13.00	13.00	13.00	13.00	3.00	3.00	3.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	21.00	13.00
5.00	5.00	15.00	15.00	15.00	5.00	15.00	5.00	5.00	5.00	15.00	5.00	15.00	5.00	15.00	15.00	15.00	15.00	15.00	21.00	5.00
3.00	3.00	13.00	13.00	13.00	13.00	13.00	3.00	3.00	3.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	21.00	13.00
3.00	3.00	20.50	12.50	12.50	12.50	12.50	3.00	3.00	3.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	20.50	12.50
3.00	3.00	12.50	12.50	3.00	12.50	12.50	3.00	3.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	20.50	20.50	12.50
3.50	3.50	13.50	13.50	13.50	3.50	13.50	3.50	3.50	3.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	21.00	13.50
2.50	2.50	13.00	13.00	13.00	13.00	13.00	2.50	13.00	2.50	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
4.50	4.50	14.50	14.50	14.50	14.50	14.50	4.50	4.50	4.50	14.50	14.50	14.50	4.50	14.50	14.50	14.50	4.50	14.50	21.00	4.50
3.00	3.00	11.00	18.50	11.00	11.00	21.00	3.00	11.00	3.00	18.50	11.00	3.00	11.00	11.00	11.00	18.50	11.00	11.00	18.50	11.00
4.00	4.00	14.50	14.50	14.50	4.00	14.50	4.00	4.00	14.50	14.50	14.50	14.50	14.50	14.50	4.00	14.50	14.50	14.50	14.50	4.00
3.00	3.00	12.00	3.00	12.00	12.00	12.00	12.00	3.00	3.00	12.00	20.00	12.00	12.00	12.00	12.00	12.00	12.00	20.00	20.00	12.00
4.00	4.00	4.00	14.50	14.50	4.00	14.50	4.00	4.00	4.00	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
3.50	3.50	13.50	3.50	13.50	13.50	13.50	13.50	3.50	3.50	13.50	13.50	13.50	13.50	13.50	3.50	13.50	13.50	13.50	21.00	13.50
3.00	3.00	12.00	12.00	12.00	12.00	12.00	12.00	3.00	3.00	20.00	12.00	12.00	12.00	12.00	3.00	20.00	12.00	12.00	20.00	12.00
3.00	13.50	13.50	13.50	13.50	13.50	13.50	3.00	3.00	3.00	13.50	13.50	13.50	13.50	3.00	13.50	13.50	13.50	13.50	13.50	13.50
2.50	2.50	12.00	12.00	12.00	2.50	12.00	2.50	12.00	12.00	12.00	12.00	12.00	12.00	20.50	12.00	12.00	12.00	12.00	20.50	12.00
4.00	4.00	13.00	13.00	4.00	13.00	20.00	4.00	4.00	4.00	13.00	4.00	13.00	13.00	13.00	13.00	13.00	20.00	13.00	20.00	13.00
2.50	12.50	12.50	12.50	12.50	12.50	12.50	2.50	2.50	2.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	21.00	12.50
4.50	4.50	15.00	15.00	15.00	4.50	15.00	4.50	4.50	4.50	15.00	15.00	15.00	4.50	15.00	15.00	15.00	15.00	15.00	15.00	4.50
5.00	5.00	15.50	15.50	15.50	5.00	15.50	5.00	5.00	5.00	15.50	15.50	15.50	5.00	15.50	5.00	15.50	15.50	15.50	15.50	5.00
4.00	4.00	4.00	4.00	13.50	13.50	13.50	4.00	4.00	4.00	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	20.50	20.50	13.50
5.50	5.50	16.00	16.00	16.00	16.00	16.00	5.50	5.50	5.50	16.00	5.50	16.00	16.00	16.00	16.00	5.50	5.50	5.50	16.00	5.50
3.00	3.00	21.00	12.50	20.00	3.00	12.50	12.50	3.00	12.50	12.50	12.50	3.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
2.50	2.50	12.50	12.50	12.50	12.50	21.00	2.50	12.50	2.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
3.00	3.00	13.50	13.50	13.50	13.50	13.50	3.00	3.00	3.00	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
2.00	2.00	11.50	11.50	11.50	11.50	11.50	2.00	11.50	11.50	11.50	11.50	11.50	11.50	11.50	20.50	11.50	11.50	11.50	20.50	11.50
3.00	3.00	13.00	13.00	13.00	13.00	13.00	13.00	3.00	3.00	13.00	13.00	13.00	3.00	13.00	13.00	13.00	13.00	13.00	21.00	13.00
15.50	15.50	15.50	5.00	15.50	15.50	5.00	5.00	5.00	15.50	5.00	5.00	15.50	15.50	15.50	5.00	5.00	15.50	5.00	15.50	15.50
2.50	2.50	17.50	17.50	9.50	9.50	9.50	2.50	9.50	17.50	9.50	21.00	9.50	17.50	17.50	9.50	2.50	17.50	9.50	9.50	9.50

Figure VIII-III: SPSS report of the 21 KCIs in the second round of interviews

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Project quality	32	100.0%	0	0.0%	32	100.0%
Safety healthy	32	100.0%	0	0.0%	32	100.0%
Social responsibility	32	100.0%	0	0.0%	32	100.0%
communication	32	100.0%	0	0.0%	32	100.0%
culture	32	100.0%	0	0.0%	32	100.0%
productivity	32	100.0%	0	0.0%	32	100.0%
Value added	32	100.0%	0	0.0%	32	100.0%
reputation	32	100.0%	0	0.0%	32	100.0%
Organisation management	32	100.0%	0	0.0%	32	100.0%
technology	32	100.0%	0	0.0%	32	100.0%
experience	32	100.0%	0	0.0%	32	100.0%
Employee management	32	100.0%	0	0.0%	32	100.0%
Risk management	32	100.0%	0	0.0%	32	100.0%
Research development	32	100.0%	0	0.0%	32	100.0%
Information technology	32	100.0%	0	0.0%	32	100.0%
costs	32	100.0%	0	0.0%	32	100.0%
asset	32	100.0%	0	0.0%	32	100.0%
revenue	32	100.0%	0	0.0%	32	100.0%
Financial source	32	100.0%	0	0.0%	32	100.0%
liability	32	100.0%	0	0.0%	32	100.0%
profit	32	100.0%	0	0.0%	32	100.0%

Descriptives

			Statistic	Std. Error
Project quality	Mean		4.94	.043
	95% Confidence Interval for Mean	Lower Bound	4.85	
		Upper Bound	5.03	
	5% Trimmed Mean		4.99	
	Median		5.00	
	Variance		.060	
	Std. Deviation		.246	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	

	Skewness		-3.795	.414
	Kurtosis		13.227	.809
Safety healthy	Mean		4.91	.052
	95% Confidence Interval for Mean	Lower Bound	4.80	
		Upper Bound	5.01	
	5% Trimmed Mean		4.95	
	Median		5.00	
	Variance		.088	
	Std. Deviation		.296	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-2.926	.414
	Kurtosis		6.999	.809
Social responsibility	Mean		3.91	.113
	95% Confidence Interval for Mean	Lower Bound	3.68	
		Upper Bound	4.14	
	5% Trimmed Mean		3.97	
	Median		4.00	
	Variance		.410	
	Std. Deviation		.641	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		0	
	Skewness		-3.063	.414
	Kurtosis		14.260	.809
communication	Mean		4.06	.077
	95% Confidence Interval for Mean	Lower Bound	3.91	
		Upper Bound	4.22	
	5% Trimmed Mean		4.07	
	Median		4.00	
	Variance		.190	
	Std. Deviation		.435	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.371	.414
	Kurtosis		2.834	.809
culture	Mean		4.03	.055

	95% Confidence Interval for Mean	Lower Bound	3.92	
		Upper Bound	4.14	
	5% Trimmed Mean		4.01	
	Median		4.00	
	Variance		.096	
	Std. Deviation		.309	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.837	.414
	Kurtosis		9.035	.809
productivity	Mean		4.25	.078
	95% Confidence Interval for Mean	Lower Bound	4.09	
		Upper Bound	4.41	
	5% Trimmed Mean		4.22	
	Median		4.00	
	Variance		.194	
	Std. Deviation		.440	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		1	
	Skewness		1.212	.414
	Kurtosis		-.570	.809
Value added	Mean		3.91	.094
	95% Confidence Interval for Mean	Lower Bound	3.72	
		Upper Bound	4.10	
	5% Trimmed Mean		3.93	
	Median		4.00	
	Variance		.281	
	Std. Deviation		.530	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-1.504	.414
	Kurtosis		5.642	.809
reputation	Mean		4.84	.065
	95% Confidence Interval for Mean	Lower Bound	4.71	
		Upper Bound	4.98	
	5% Trimmed Mean		4.88	

	Median		5.00	
	Variance		.136	
	Std. Deviation		.369	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.988	.414
	Kurtosis		2.078	.809
Organisation management	Mean		4.81	.070
	95% Confidence Interval for Mean	Lower Bound	4.67	
		Upper Bound	4.96	
	5% Trimmed Mean		4.85	
	Median		5.00	
	Variance		.157	
	Std. Deviation		.397	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.681	.414
	Kurtosis		.877	.809
technology	Mean		4.72	.092
	95% Confidence Interval for Mean	Lower Bound	4.53	
		Upper Bound	4.91	
	5% Trimmed Mean		4.78	
	Median		5.00	
	Variance		.273	
	Std. Deviation		.523	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		1	
	Skewness		-1.721	.414
	Kurtosis		2.324	.809
experience	Mean		3.97	.055
	95% Confidence Interval for Mean	Lower Bound	3.86	
		Upper Bound	4.08	
	5% Trimmed Mean		3.99	
	Median		4.00	
	Variance		.096	
	Std. Deviation		.309	

	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		-.837	.414
	Kurtosis		9.035	.809
Employee management	Mean		4.03	.095
	95% Confidence Interval for Mean	Lower Bound	3.84	
		Upper Bound	4.23	
	5% Trimmed Mean		4.07	
	Median		4.00	
	Variance		.289	
	Std. Deviation		.538	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-1.292	.414
	Kurtosis		6.827	.809
Risk management	Mean		4.09	.052
	95% Confidence Interval for Mean	Lower Bound	3.99	
		Upper Bound	4.20	
	5% Trimmed Mean		4.05	
	Median		4.00	
	Variance		.088	
	Std. Deviation		.296	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		2.926	.414
	Kurtosis		6.999	.809
Research development	Mean		4.16	.079
	95% Confidence Interval for Mean	Lower Bound	3.99	
		Upper Bound	4.32	
	5% Trimmed Mean		4.15	
	Median		4.00	
	Variance		.201	
	Std. Deviation		.448	
	Minimum		3	
	Maximum		5	
	Range		2	

	Interquartile Range		0	
	Skewness		.752	.414
	Kurtosis		1.398	.809
Information technology	Mean		3.97	.071
	95% Confidence Interval for Mean	Lower Bound	3.82	
		Upper Bound	4.11	
	5% Trimmed Mean		3.97	
	Median		4.00	
	Variance		.160	
	Std. Deviation		.400	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		-.286	.414
	Kurtosis		4.161	.809
costs	Mean		4.13	.074
	95% Confidence Interval for Mean	Lower Bound	3.97	
		Upper Bound	4.28	
	5% Trimmed Mean		4.12	
	Median		4.00	
	Variance		.177	
	Std. Deviation		.421	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.863	.414
	Kurtosis		2.332	.809
asset	Mean		4.00	.078
	95% Confidence Interval for Mean	Lower Bound	3.84	
		Upper Bound	4.16	
	5% Trimmed Mean		4.00	
	Median		4.00	
	Variance		.194	
	Std. Deviation		.440	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.000	.414
	Kurtosis		2.957	.809

revenue	Mean		4.03	.071
	95% Confidence Interval for Mean	Lower Bound	3.89	
		Upper Bound	4.18	
	5% Trimmed Mean		4.03	
	Median		4.00	
	Variance		.160	
	Std. Deviation		.400	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.286	.414
	Kurtosis		4.161	.809
Financial source	Mean		3.97	.071
	95% Confidence Interval for Mean	Lower Bound	3.82	
		Upper Bound	4.11	
	5% Trimmed Mean		3.97	
	Median		4.00	
	Variance		.160	
	Std. Deviation		.400	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		-.286	.414
	Kurtosis		4.161	.809
Liability	Mean		3.41	.088
	95% Confidence Interval for Mean	Lower Bound	3.23	
		Upper Bound	3.59	
	5% Trimmed Mean		3.40	
	Median		3.00	
	Variance		.249	
	Std. Deviation		.499	
	Minimum		3	
	Maximum		4	
	Range		1	
	Interquartile Range		1	
	Skewness		.401	.414
	Kurtosis		-1.967	.809
profit	Mean		4.22	.074
	95% Confidence Interval for Mean	Lower Bound	4.07	
		Upper Bound	4.37	

	5% Trimmed Mean	4.19	
	Median	4.00	
	Variance	.176	
	Std. Deviation	.420	
	Minimum	4	
	Maximum	5	
	Range	1	
	Interquartile Range	0	
	Skewness	1.429	.414
	Kurtosis	.039	.809

Kendall's W Test

Ranks

	Mean Rank
KCI1	4.09
KCI2	4.44
KCI3	13.38
KCI4	12.50
KCI5	12.89
KCI6	10.70
KCI7	13.61
KCI8	4.95
KCI9	5.17
KCI10	6.08
KCI11	13.39
KCI12	12.59
KCI13	12.38
KCI14	11.59
KCI15	13.31
KCI16	11.94
KCI17	13.11
KCI18	12.77
KCI19	13.30
KCI20	17.81
KCI21	11.00

Test Statistics

N	32
Kendall's W[a]	.531
Chi-Square	339.756
df	20
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance

Figure VIII-IV: The additional KCIs' rating for each participant

KCI-22	KCI-23	KCI-24	KCI-25	KCI-26	KCI-27	KCI-28	KCI-29	KCI-30	KCI-31	KCI-32	KCI-33	KCI-34	KCI-35	KCI-36	KCI-37	KCI-38	KCI-39	KCI-40	KCI-41	KCI-42	KCI-43	KCI-44	KCI-45	KCI-46	KCI-47	KCI-48	KCI-49	KCI-50	KCI-51	KCI-52	KCI-53
5	4	4	3	5	4	5	4	4	4	4	5	5	4	5	5	4	5	5	3	4	4	4	2	5	4	4	5	4	4	4	5
4	5	5	4	5	4	5	4	4	4	4	5	5	5	5	4	4	5	4	3	3	4	4	3	5	4	4	5	4	4	4	5
4	4	4	3	5	5	5	4	4	4	4	5	5	5	5	4	4	5	4	3	4	4	4	3	5	3	4	5	5	5	4	5
4	4	4	3	5	4	5	4	5	4	4	4	5	5	5	4	4	5	4	3	4	4	4	3	5	4	4	4	4	4	4	5
4	4	4	3	5	4	5	4	4	4	4	5	5	5	5	4	4	5	4	3	4	4	5	4	5	4	4	5	4	4	4	5
5	3	4	3	5	4	5	5	4	4	4	5	5	5	5	4	4	5	4	3	4	4	4	3	5	4	5	5	4	4	4	5
4	4	4	4	5	4	5	4	4	4	5	5	5	5	4	4	4	4	4	4	4	4	4	3	5	4	4	5	4	4	4	4
4	4	4	3	4	4	5	4	4	4	4	5	4	5	5	5	4	5	4	3	4	4	4	3	5	5	4	5	4	4	4	5
4	4	4	3	5	5	5	4	4	4	4	5	5	5	5	4	4	5	4	3	4	4	4	3	5	4	5	4	4	4	5	5
5	4	4	3	5	4	5	5	4	4	4	5	5	5	4	5	5	4	4	2	4	4	4	3	5	3	4	5	4	4	4	5
4	4	4	2	5	5	5	4	4	4	5	5	5	5	5	4	5	5	5	3	5	4	4	3	5	4	4	5	4	5	5	5
4	5	4	3	5	4	5	4	4	5	4	5	5	5	5	4	4	5	4	4	4	4	4	3	5	4	4	4	3	4	4	5
4	4	4	3	5	4	5	4	5	4	4	5	5	4	5	4	4	5	4	3	4	5	4	3	5	4	4	5	4	4	5	5
4	4	4	4	4	3	4	4	4	4	5	4	5	5	5	4	3	4	4	3	4	4	4	3	4	4	4	4	4	4	4	5
4	4	4	3	5	4	5	4	4	4	4	5	4	5	5	4	4	5	4	3	4	4	4	3	5	3	4	5	4	4	4	5
4	4	5	3	4	4	4	4	4	4	4	5	5	5	5	4	4	5	4	3	4	4	4	4	4	4	4	5	4	4	4	4
4	4	5	3	5	4	5	4	4	4	4	5	5	5	5	4	4	5	4	3	4	4	4	3	5	4	4	5	4	4	4	5
4	4	4	3	5	4	5	4	4	5	4	5	5	5	5	4	4	5	5	3	4	5	4	3	5	4	4	5	4	4	4	5
4	3	4	3	4	4	5	4	4	4	4	4	5	4	4	5	4	5	4	3	4	4	4	3	5	4	4	5	4	4	5	5
4	2	3	3	4	4	4	4	4	4	3	5	5	5	5	5	4	5	4	3	3	4	4	3	4	3	4	5	4	4	4	5
4	4	4	4	5	4	5	4	5	4	4	5	5	5	5	4	4	5	4	3	4	5	3	3	5	4	4	5	4	4	4	5
5	5	4	3	5	4	5	4	4	4	4	4	4	5	4	4	4	5	4	4	4	4	4	3	5	4	4	5	4	5	5	5
4	4	5	4	5	4	5	4	4	4	5	5	5	5	5	4	5	5	5	3	4	5	4	3	5	4	5	5	3	4	4	5
4	4	4	3	5	3	4	5	4	4	4	5	5	5	5	5	4	5	4	5	4	4	4	3	5	4	4	5	4	5	5	5
4	4	4	3	4	5	4	4	4	4	4	5	4	4	4	4	4	4	5	3	5	4	4	3	5	4	4	4	4	4	4	5
4	4	4	4	5	4	5	5	4	4	4	5	4	4	5	4	4	5	4	3	4	5	4	3	5	4	4	5	4	4	4	4
4	4	4	3	5	4	5	4	4	4	4	4	5	5	4	4	4	5	4	3	4	4	5	3	4	4	5	5	3	5	5	5
5	4	5	4	5	5	4	4	4	4	4	5	5	5	5	4	4	5	5	3	5	4	3	5	5	5	3	4	4	3	4	4
4	5	4	3	5	4	5	4	4	5	4	5	4	5	5	5	4	5	4	3	4	5	4	4	5	4	4	5	4	4	5	5
5	5	4	4	5	4	5	5	5	4	5	5	5	5	5	5	4	5	4	3	4	4	4	3	5	4	4	5	4	4	5	5
4	4	4	3	4	4	4	5	4	4	4	4	4	4	3	5	4	5	4	4	4	4	4	5	4	4	4	5	5	4	4	4
5	4	4	5	3	4	5	4	4	4	3	5	5	5	5	3	2	5	5	5	3	4	4	5	2	5	2	2	4	1	5	5

Figure VIII-V: The additional KCIs' ranking average for each participant

KCI22	KCI23	KCI24	KCI25	KCI26	KCI27	KCI28	KCI29	KCI30	KCI31	KCI32	KCI33	KCI34	KCI35	KCI36	KCI37	KCI38	KCI39	KCI40	KCI41	KCI42	KCI43	KCI44	KCI45	KCI46	KCI47	KCI48	KCI49	KCI50	KCI51	KCI52	KCI53
6.50	21.00	21.00	30.50	6.50	21.00	6.50	21.00	21.00	21.00	21.00	6.50	6.50	21.00	6.50	6.50	21.00	6.50	6.50	30.50	21.00	21.00	21.00	32.00	6.50	21.00	21.00	6.50	21.00	21.00	21.00	6.50
21.00	6.50	6.50	21.00	6.50	21.00	6.50	21.00	21.00	21.00	21.00	6.50	6.50	6.50	6.50	21.00	21.00	6.50	21.00	31.00	31.00	21.00	21.00	31.00	6.50	21.00	21.00	6.50	21.00	21.00	21.00	6.50
21.00	21.00	21.00	30.50	7.00	7.00	7.00	21.00	21.00	21.00	21.00	7.00	7.00	7.00	7.00	21.00	21.00	7.00	21.00	30.50	21.00	21.00	21.00	30.50	7.00	30.50	21.00	7.00	7.00	7.00	21.00	7.00
19.50	19.50	19.50	31.00	5.00	19.50	5.00	19.50	5.00	19.50	19.50	19.50	5.00	5.00	5.00	19.50	19.50	5.00	19.50	31.00	19.50	19.50	19.50	31.00	5.00	19.50	19.50	19.50	19.50	19.50	19.50	5.00
21.00	21.00	21.00	31.50	6.00	21.00	6.00	21.00	21.00	21.00	21.00	6.00	6.00	6.00	6.00	21.00	21.00	6.00	21.00	31.50	21.00	21.00	6.00	21.00	6.00	21.00	21.00	6.00	21.00	21.00	21.00	6.00
7.00	30.50	21.00	30.50	7.00	21.00	7.00	7.00	21.00	21.00	21.00	7.00	7.00	7.00	7.00	21.00	21.00	7.00	21.00	30.50	21.00	21.00	21.00	30.50	7.00	21.00	7.00	7.00	21.00	21.00	21.00	7.00
20.00	20.00	20.00	20.00	4.50	20.00	4.50	20.00	20.00	20.00	4.50	4.50	4.50	4.50	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	32.00	4.50	20.00	20.00	4.50	20.00	20.00	20.00	20.00
20.00	20.00	20.00	31.00	20.00	20.00	5.50	20.00	20.00	20.00	20.00	5.50	20.00	5.50	5.50	5.50	20.00	5.50	20.00	31.00	20.00	20.00	20.00	31.00	5.50	5.50	20.00	5.50	20.00	20.00	20.00	5.50
21.00	21.00	21.00	31.00	6.50	6.50	6.50	21.00	21.00	21.00	21.00	6.50	6.50	6.50	6.50	21.00	21.00	6.50	21.00	31.00	21.00	21.00	21.00	31.00	6.50	21.00	6.50	21.00	21.00	21.00	6.50	6.50
6.50	20.50	20.50	30.00	6.50	20.50	6.50	6.50	20.50	20.50	20.50	6.50	6.50	6.50	20.50	6.50	6.50	20.50	20.50	32.00	20.50	20.50	20.50	30.00	6.50	30.00	20.50	6.50	20.50	20.50	20.50	6.50
23.50	23.50	23.50	32.00	9.00	9.00	9.00	23.50	23.50	23.50	9.00	9.00	9.00	9.00	9.00	23.50	9.00	9.00	9.00	30.50	9.00	23.50	23.50	30.50	9.00	23.50	23.50	9.00	23.50	9.00	9.00	9.00
20.50	6.00	20.50	31.00	6.00	20.50	6.00	20.50	20.50	6.00	20.50	6.00	6.00	6.00	6.00	20.50	20.50	6.00	20.50	20.50	20.50	20.50	20.50	31.00	6.00	20.50	2035.00	20.50	31.00	20.50	20.50	6.00
21.00	21.00	21.00	31.00	6.50	21.00	6.50	21.00	6.50	21.00	21.00	6.50	6.50	21.00	6.50	21.00	21.00	6.50	21.00	31.00	21.00	6.50	21.00	31.00	6.50	21.00	21.00	6.50	21.00	21.00	6.50	6.50
17.00	17.00	17.00	17.00	17.00	30.50	17.00	17.00	17.00	17.00	3.00	17.00	3.00	3.00	3.00	17.00	30.50	17.00	17.00	30.50	17.00	17.00	17.00	30.50	17.00	17.00	17.00	17.00	17.00	17.00	17.00	3.00
19.00	19.00	19.00	30.50	5.00	19.00	5.00	19.00	19.00	19.00	19.00	5.00	19.00	5.00	5.00	19.00	19.00	5.00	19.00	30.50	19.00	19.00	19.00	30.50	5.00	30.50	19.00	5.00	19.00	19.00	19.00	5.00
19.00	19.00	4.00	31.50	19.00	19.00	19.00	19.00	19.00	19.00	19.00	4.00	4.00	4.00	4.00	19.00	19.00	4.00	19.00	31.50	19.00	19.00	19.00	19.00	19.00	19.00	19.00	4.00	19.00	19.00	19.00	19.00
20.50	20.50	6.00	31.00	6.00	20.50	6.00	20.50	20.50	20.50	20.50	6.00	6.00	6.00	6.00	20.50	20.50	6.00	20.50	31.00	20.50	20.50	20.50	31.00	6.00	20.50	20.50	6.00	20.50	20.50	20.50	6.00
21.50	21.50	21.50	31.00	7.00	21.50	7.00	21.50	21.50	7.00	21.50	7.00	7.00	7.00	7.00	21.50	21.50	7.00	7.00	31.00	21.50	7.00	21.50	31.00	7.00	21.50	21.50	7.00	21.50	21.50	21.50	7.00
18.50	30.50	18.50	30.50	18.50	18.50	4.50	18.50	18.50	18.50	18.50	18.50	4.50	18.50	18.50	4.50	18.50	4.50	18.50	30.50	18.50	18.50	18.50	30.50	4.50	18.50	18.50	4.50	18.50	18.50	4.50	4.50
16.50	32.00	28.00	28.00	16.50	16.50	16.50	16.50	16.50	16.50	28.00	4.50	4.50	4.50	4.50	4.50	16.50	4.50	16.50	28.00	28.00	16.50	16.50	28.00	16.50	28.00	16.50	4.50	16.50	16.50	16.50	4.50
21.00	21.00	21.00	21.00	6.50	21.00	6.50	21.00	6.50	21.00	21.00	6.50	6.50	6.50	6.50	21.00	21.00	6.50	21.00	31.00	21.00	6.50	31.00	31.00	6.50	21.00	21.00	6.50	21.00	21.00	21.00	6.50
6.00	6.00	21.00	31.50	6.00	21.00	6.00	21.00	21.00	21.00	21.00	21.00	21.00	6.00	21.00	21.00	21.00	6.00	21.00	21.00	21.00	21.00	21.00	31.50	6.00	21.00	21.00	6.00	21.00	6.00	6.00	6.00
23.00	23.00	8.50	23.00	8.50	23.00	8.50	23.00	23.00	23.00	8.50	8.50	8.50	8.50	8.50	23.00	8.50	8.50	8.50	31.00	23.00	8.50	23.00	31.00	8.50	23.00	8.50	8.50	31.00	23.00	23.00	8.50
22.00	22.00	22.00	31.00	7.50	31.00	22.00	7.50	22.00	22.00	22.00	7.50	7.50	7.50	7.50	7.50	22.00	7.50	22.00	7.50	22.00	22.00	22.00	31.00	7.50	22.00	22.00	7.50	22.00	7.50	7.50	7.50
18.00	18.00	18.00	31.00	18.00	3.50	18.00	18.00	18.00	18.00	18.00	3.50	18.00	18.00	18.00	18.00	18.00	18.00	3.50	31.00	3.50	18.00	18.00	31.00	3.50	18.00	18.00	18.00	18.00	18.00	18.00	3.50
20.00	20.00	20.00	20.00	5.00	20.00	5.00	5.00	20.00	20.00	20.00	5.00	20.00	20.00	5.00	20.00	20.00	5.00	20.00	31.50	20.00	5.00	20.00	31.50	5.00	20.00	20.00	5.00	20.00	20.00	20.00	20.00
20.00	20.00	20.00	30.50	6.00	20.00	6.00	20.00	20.00	20.00	20.00	20.00	6.00	6.00	20.00	20.00	20.00	6.00	20.00	30.50	20.00	20.00	6.00	30.50	20.00	20.00	6.00	6.00	30.50	6.00	6.00	6.00
7.50	21.50	7.50	21.50	7.50	7.50	21.50	21.50	21.50	21.50	21.50	7.50	7.50	7.50	7.50	21.50	21.50	7.50	7.50	30.50	7.50	21.50	30.50	7.50	7.50	7.50	30.50	21.50	21.50	30.50	21.50	21.50
22.50	7.50	22.50	31.50	7.50	22.50	7.50	22.50	22.50	7.50	22.50	7.50	22.50	7.50	7.50	7.50	22.50	7.50	22.50	31.50	22.50	7.50	22.50	22.50	7.50	22.50	22.50	7.50	22.50	22.50	7.50	7.50
9.00	9.00	24.00	24.00	9.00	24.00	9.00	9.00	9.00	24.00	9.00	9.00	9.00	9.00	9.00	9.00	24.00	9.00	24.00	31.50	24.00	24.00	24.00	31.50	9.00	24.00	24.00	9.00	24.00	24.00	9.00	9.00
18.50	18.50	18.50	31.50	18.50	18.50	18.50	3.50	18.50	18.50	18.50	18.50	18.50	18.50	31.50	3.50	18.50	3.50	18.50	18.50	18.50	18.50	18.50	3.50	18.50	18.50	18.50	3.50	3.50	18.50	18.50	18.50
7.50	19.00	19.00	7.50	25.50	19.00	7.50	19.00	19.00	19.00	25.50	7.50	7.50	7.50	7.50	25.50	29.50	7.50	7.50	7.50	25.50	19.00	19.00	7.50	29.50	7.50	29.50	29.50	19.00	32.00	7.50	7.50

Figure VIII-VI: SPSS report of the additional KCIs in the second round of interviews

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
information acquisition	32	100.0%	0	0.0%	32	100.0%
China political influence	32	100.0%	0	0.0%	32	100.0%
the relationship between China and other countries	32	100.0%	0	0.0%	32	100.0%
Nation protectionism	32	100.0%	0	0.0%	32	100.0%
Safety management	32	100.0%	0	0.0%	32	100.0%
financing methods	32	100.0%	0	0.0%	32	100.0%
Biding price	32	100.0%	0	0.0%	32	100.0%
Costs control	32	100.0%	0	0.0%	32	100.0%
Project warranty	32	100.0%	0	0.0%	32	100.0%
nation policy	32	100.0%	0	0.0%	32	100.0%
level of internationalization	32	100.0%	0	0.0%	32	100.0%
understanding the market	32	100.0%	0	0.0%	32	100.0%
quality assurance	32	100.0%	0	0.0%	32	100.0%
advanced technologies	32	100.0%	0	0.0%	32	100.0%
The selection construction technology	32	100.0%	0	0.0%	32	100.0%
leadership	32	100.0%	0	0.0%	32	100.0%
training and welfare	32	100.0%	0	0.0%	32	100.0%
Contract management	32	100.0%	0	0.0%	32	100.0%
Information management	32	100.0%	0	0.0%	32	100.0%
claims on the project	32	100.0%	0	0.0%	32	100.0%
The knowledge of accounting and tax	32	100.0%	0	0.0%	32	100.0%
Employee quality	32	100.0%	0	0.0%	32	100.0%
Employee localisation	32	100.0%	0	0.0%	32	100.0%
Company qualification	32	100.0%	0	0.0%	32	100.0%
strategy of bidding	32	100.0%	0	0.0%	32	100.0%
political environment	32	100.0%	0	0.0%	32	100.0%
Agility adaptability responses	32	100.0%	0	0.0%	32	100.0%
Management change	32	100.0%	0	0.0%	32	100.0%
Regulation and legal framework	32	100.0%	0	0.0%	32	100.0%
local values and idiosyncrasies	32	100.0%	0	0.0%	32	100.0%
Corporate knowledge	32	100.0%	0	0.0%	32	100.0%
Brand	32	100.0%	0	0.0%	32	100.0%

Descriptives

			Statistic	Std. Error
information acquisition	Mean		4.22	.074
	95% Confidence Interval for Mean	Lower Bound	4.07	
		Upper Bound	4.37	
	5% Trimmed Mean		4.19	
	Median		4.00	
	Variance		.176	
	Std. Deviation		.420	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		1.429	.414
	Kurtosis		.039	.809
China political influence	Mean		4.03	.105
	95% Confidence Interval for Mean	Lower Bound	3.82	
		Upper Bound	4.25	
	5% Trimmed Mean		4.07	
	Median		4.00	
	Variance		.354	
	Std. Deviation		.595	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-.986	.414
	Kurtosis		4.095	.809
the relationship between China and other countries	Mean		4.13	.074
	95% Confidence Interval for Mean	Lower Bound	3.97	
		Upper Bound	4.28	
	5% Trimmed Mean		4.12	
	Median		4.00	
	Variance		.177	
	Std. Deviation		.421	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	

	Skewness		.863	.414
	Kurtosis		2.332	.809
Nation protectionism	Mean		3.28	.103
	95% Confidence Interval for Mean	Lower Bound	3.07	
		Upper Bound	3.49	
	5% Trimmed Mean		3.26	
	Median		3.00	
	Variance		.338	
	Std. Deviation		.581	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		1	
	Skewness		.956	.414
	Kurtosis		1.388	.809
Safety management	Mean		4.72	.092
	95% Confidence Interval for Mean	Lower Bound	4.53	
		Upper Bound	4.91	
	5% Trimmed Mean		4.78	
	Median		5.00	
	Variance		.273	
	Std. Deviation		.523	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		1	
	Skewness		-1.721	.414
	Kurtosis		2.324	.809
financing methods	Mean		4.09	.082
	95% Confidence Interval for Mean	Lower Bound	3.93	
		Upper Bound	4.26	
	5% Trimmed Mean		4.10	
	Median		4.00	
	Variance		.217	
	Std. Deviation		.466	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.370	.414
	Kurtosis		1.885	.809
Biding price	Mean		4.78	.074

	95% Confidence Interval for Mean	Lower Bound	4.63	
		Upper Bound	4.93	
	5% Trimmed Mean		4.81	
	Median		5.00	
	Variance		.176	
	Std. Deviation		.420	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.429	.414
	Kurtosis		.039	.809
Costs control	Mean		4.19	.070
	95% Confidence Interval for Mean	Lower Bound	4.04	
		Upper Bound	4.33	
	5% Trimmed Mean		4.15	
	Median		4.00	
	Variance		.157	
	Std. Deviation		.397	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		1.681	.414
	Kurtosis		.877	.809
Project warranty	Mean		4.13	.059
	95% Confidence Interval for Mean	Lower Bound	4.00	
		Upper Bound	4.25	
	5% Trimmed Mean		4.08	
	Median		4.00	
	Variance		.113	
	Std. Deviation		.336	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		2.381	.414
	Kurtosis		3.909	.809
nation policy	Mean		4.09	.052
	95% Confidence Interval for Mean	Lower Bound	3.99	
		Upper Bound	4.20	
	5% Trimmed Mean		4.05	

	Median		4.00	
	Variance		.088	
	Std. Deviation		.296	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		2.926	.414
	Kurtosis		6.999	.809
level of internationalization	Mean		4.09	.082
	95% Confidence Interval for Mean	Lower Bound	3.93	
		Upper Bound	4.26	
	5% Trimmed Mean		4.10	
	Median		4.00	
	Variance		.217	
	Std. Deviation		.466	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.370	.414
	Kurtosis		1.885	.809
understanding the market	Mean		4.81	.070
	95% Confidence Interval for Mean	Lower Bound	4.67	
		Upper Bound	4.96	
	5% Trimmed Mean		4.85	
	Median		5.00	
	Variance		.157	
	Std. Deviation		.397	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.681	.414
	Kurtosis		.877	.809
quality assurance	Mean		4.78	.074
	95% Confidence Interval for Mean	Lower Bound	4.63	
		Upper Bound	4.93	
	5% Trimmed Mean		4.81	
	Median		5.00	
	Variance		.176	
	Std. Deviation		.420	

	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.429	.414
	Kurtosis		.039	.809
advanced technologies	Mean		4.81	.070
	95% Confidence Interval for Mean	Lower Bound	4.67	
		Upper Bound	4.96	
	5% Trimmed Mean		4.85	
	Median		5.00	
	Variance		.157	
	Std. Deviation		.397	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.681	.414
	Kurtosis		.877	.809
The selection construction technology	Mean		4.75	.090
	95% Confidence Interval for Mean	Lower Bound	4.57	
		Upper Bound	4.93	
	5% Trimmed Mean		4.81	
	Median		5.00	
	Variance		.258	
	Std. Deviation		.508	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		-1.969	.414
	Kurtosis		3.374	.809
leadership	Mean		4.25	.090
	95% Confidence Interval for Mean	Lower Bound	4.07	
		Upper Bound	4.43	
	5% Trimmed Mean		4.26	
	Median		4.00	
	Variance		.258	
	Std. Deviation		.508	
	Minimum		3	
	Maximum		5	
	Range		2	

	Interquartile Range		1	
	Skewness		.394	.414
	Kurtosis		-.154	.809
training and welfare	Mean		4.00	.090
	95% Confidence Interval for Mean	Lower Bound	3.82	
		Upper Bound	4.18	
	5% Trimmed Mean		4.03	
	Median		4.00	
	Variance		.258	
	Std. Deviation		.508	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-1.575	.414
	Kurtosis		8.445	.809
Contract management	Mean		4.88	.059
	95% Confidence Interval for Mean	Lower Bound	4.75	
		Upper Bound	5.00	
	5% Trimmed Mean		4.92	
	Median		5.00	
	Variance		.113	
	Std. Deviation		.336	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-2.381	.414
	Kurtosis		3.909	.809
Information management	Mean		4.22	.074
	95% Confidence Interval for Mean	Lower Bound	4.07	
		Upper Bound	4.37	
	5% Trimmed Mean		4.19	
	Median		4.00	
	Variance		.176	
	Std. Deviation		.420	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		1.429	.414
	Kurtosis		.039	.809

claims on the project	Mean		3.22	.108
	95% Confidence Interval for Mean	Lower Bound	3.00	
		Upper Bound	3.44	
	5% Trimmed Mean		3.17	
	Median		3.00	
	Variance		.370	
	Std. Deviation		.608	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		1.703	.414
	Kurtosis		3.520	.809
The knowledge of accounting and tax	Mean		4.00	.078
	95% Confidence Interval for Mean	Lower Bound	3.84	
		Upper Bound	4.16	
	5% Trimmed Mean		4.00	
	Median		4.00	
	Variance		.194	
	Std. Deviation		.440	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.000	.414
	Kurtosis		2.957	.809
Employee quality	Mean		4.19	.070
	95% Confidence Interval for Mean	Lower Bound	4.04	
		Upper Bound	4.33	
	5% Trimmed Mean		4.15	
	Median		4.00	
	Variance		.157	
	Std. Deviation		.397	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		1.681	.414
	Kurtosis		.877	.809
Employee localisation	Mean		4.00	.064
	95% Confidence Interval for Mean	Lower Bound	3.87	
		Upper Bound	4.13	

	5% Trimmed Mean		4.00	
	Median		4.00	
	Variance		.129	
	Std. Deviation		.359	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		.000	.414
	Kurtosis		6.093	.809
Company qualification	Mean		3.25	.119
	95% Confidence Interval for Mean	Lower Bound	3.01	
		Upper Bound	3.49	
	5% Trimmed Mean		3.20	
	Median		3.00	
	Variance		.452	
	Std. Deviation		.672	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		1.701	.414
	Kurtosis		2.757	.809
strategy of bidding	Mean		4.75	.110
	95% Confidence Interval for Mean	Lower Bound	4.53	
		Upper Bound	4.97	
	5% Trimmed Mean		4.85	
	Median		5.00	
	Variance		.387	
	Std. Deviation		.622	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-3.215	.414
	Kurtosis		12.070	.809
political environment	Mean		3.97	.084
	95% Confidence Interval for Mean	Lower Bound	3.80	
		Upper Bound	4.14	
	5% Trimmed Mean		3.97	
	Median		4.00	
	Variance		.225	

	Std. Deviation		.474	
	Minimum		3	
	Maximum		5	
	Range		2	
	Interquartile Range		0	
	Skewness		-.112	.414
	Kurtosis		2.045	.809
Agility adaptability responses	Mean		4.03	.095
	95% Confidence Interval for Mean	Lower Bound	3.84	
		Upper Bound	4.23	
	5% Trimmed Mean		4.07	
	Median		4.00	
	Variance		.289	
	Std. Deviation		.538	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-1.292	.414
	Kurtosis		6.827	.809
Management change	Mean		4.72	.112
	95% Confidence Interval for Mean	Lower Bound	4.49	
		Upper Bound	4.95	
	5% Trimmed Mean		4.81	
	Median		5.00	
	Variance		.402	
	Std. Deviation		.634	
	Minimum		2	
	Maximum		5	
	Range		3	
	Interquartile Range		0	
	Skewness		-2.936	.414
	Kurtosis		10.335	.809
Regulation and legal framework	Mean		3.97	.071
	95% Confidence Interval for Mean	Lower Bound	3.82	
		Upper Bound	4.11	
	5% Trimmed Mean		3.97	
	Median		4.00	
	Variance		.160	
	Std. Deviation		.400	
	Minimum		3	
	Maximum		5	

	Range		2	
	Interquartile Range		0	
	Skewness		-.286	.414
	Kurtosis		4.161	.809
local values and idiosyncrasies	Mean		4.03	.123
	95% Confidence Interval for Mean	Lower Bound	3.78	
		Upper Bound	4.28	
	5% Trimmed Mean		4.10	
	Median		4.00	
	Variance		.483	
	Std. Deviation		.695	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		0	
	Skewness		-2.503	.414
	Kurtosis		11.794	.809
Corporate knowledge	Mean		4.31	.083
	95% Confidence Interval for Mean	Lower Bound	4.14	
		Upper Bound	4.48	
	5% Trimmed Mean		4.29	
	Median		4.00	
	Variance		.222	
	Std. Deviation		.471	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		1	
	Skewness		.849	.414
	Kurtosis		-1.368	.809
Brand	Mean		4.84	.065
	95% Confidence Interval for Mean	Lower Bound	4.71	
		Upper Bound	4.98	
	5% Trimmed Mean		4.88	
	Median		5.00	
	Variance		.136	
	Std. Deviation		.369	
	Minimum		4	
	Maximum		5	
	Range		1	
	Interquartile Range		0	
	Skewness		-1.988	.414

Kurtosis	2.078	.809

Kendall's W Test

Ranks

	Mean Rank
KCI22	17.34
KCI23	19.27
KCI24	18.50
KCI25	27.61
KCI26	9.73
KCI27	18.88
KCI28	9.17
KCI29	17.67
KCI30	18.58
KCI31	19.05
KCI32	18.67
KCI33	8.78
KCI34	9.30
KCI35	8.81
KCI36	9.67
KCI37	16.59
KCI38	19.81
KCI39	7.89
KCI40	17.34
KCI41	28.02
KCI42	19.94
KCI43	17.66
KCI44	20.09

KCI45	27.56
KCI46	8.95
KCI47	20.47
KCI48	19.61
KCI49	9.44
KCI50	20.39
KCI51	18.84
KCI52	15.95
KCI53	8.41

Test Statistics

N	32
Kendall's W[a]	.509
Chi-Square	504.842
df	31
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance